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# ***JPRS Report***

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## SCIENCE &amp; TECHNOLOGY

## CHINA

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## AERONAUTICAL INSTITUTES, AIR FORCE FLIGHT SCHOOL HIGHLIGHTED

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 5, May 87, pp 12-13

[Article by Zhang Fenglin [1728 7328 2651], Cheng Zhijing [4453 5267 0079]

[Text] The Ministry of Aviation Industry has under its jurisdiction seven higher aeronautical institutes. Three of them are classified as China's key universities: The Beijing Aeronautical Institute (located in Beijing), the Northwest Industrial University (located in Xi'an), and the Nanjing Aeronautical Institute (located in Nanjing); three are traditional universities: The Shenyang College of Aviation Industry (located in Shenyang City), the Nanchang College of Aviation Industry (located in Nanchang City); also, there is the Xi'an Technical School of Aviation Industry, which admits graduates from junior high schools and has both a 4-year and a 5-year curriculum.

Most of the higher aeronautical institutes were established in the early 1950's. Today they offer more than 50 specialized disciplines which include aircraft design, aircraft engines, electronic engineering, aerospace engineering, automatic control, aircraft manufacturing, computer science, electric instrumentation, mathematical and analytical mechanics, machine building, material science and engineering, navigation engineering, industrial management, information engineering, industrial and foreign trade, financial management and economics, architectural engineering, non-destructive testing, safety engineering, environmental protection and social science. The schools are authorized to offer a master's degree in 48 disciplines and a doctor's degree in 23 disciplines. The Beijing Aeronautical Institute, the Northwest Industrial University, the Nanjing Aeronautical Institute and the Nanchang College of Aviation Industry are certified to admit graduate students on the master's level; the Beijing Aeronautical Institute, the Northwest Industrial University and the Nanjing Aeronautical Institute are certified to admit graduate students on the PhD level. The Beijing Aeronautical Institute and the Northwest industrial University also have separate graduate schools. Each year, approximately 800 graduate students are enrolled in the higher aeronautical institutes. The faculty and staff at the institutes include more than 300 full professors, 1,300 assistant professors and 4,000 lecturers. Each school has a computer center and a television education center as well as well-equipped laboratories. In addition to achieving a reputation in teaching and research, the institutes have also established student exchange programs with more than 30 schools in 6 different countries.

The main objectives of the aeronautical institutes are to cultivate well-rounded, highly skilled scientific and engineering personnel. They are multi-disciplined engineering universities with major emphasis on aeronautics and aerospace; they also emphasize military-civilian cooperation, and cooperation between technology, liberal arts and management. They are not military schools for training flight personnel or commanding officers for the Air Force. The graduates from aeronautical institutes are primarily assigned to jobs in the research, design and production units of the aviation industry and at higher institutions to engage in activities of research, engineering, management and teaching. As the factories and offices of China's aviation industry are mostly located in the 18 provincial capitals and cities, 80 percent of the graduates will be assigned to China's major cities. A small number of graduates may also be assigned to military units where urgent needs for technical personnel exist.

To help incoming students in the process of selecting a school and a major course of study, we shall give a brief introduction of the 1987 recruiting policies of the aeronautical institutes.

This year, the aeronautical institutes plan to recruit 4,700 primary students and 600 specialized students. More than 4,800 will be admitted under the state plan; and over 480 will be admitted under the commission training program. In order to coordinate the recruitment of new students with job assignments, students are recruited from 28 different provinces, cities and autonomous regions (except Tibet) across the country.

A few remarks should also be made concerning the changes and special requirements of the recruiting process. In order to comply with the strategic guideline of "military-civilian cooperation," and to better prepare the graduates in meeting the development needs of the aviation industry and the needs of socialistic modernization, an adjustment has been made in the ratio of specializations in this year's recruiting plan. The number of students specialized in military products will be limited; but the number of students in general study will be increased. Also, more students will be recruited from regions with a concentration of aeronautical industries. In order to ensure that sufficient number of graduates will be assigned to meet the urgent needs of national defense, the aeronautical institutes reserved 160 slots for students from military districts in Shaxi, Guizhou, Sichuan, Hunan, and Hubei Provinces, which is in compliance with the guidelines of the State Education Commission, the Beijing Aeronautical institute and the northwest industrial University have admitted several talented high school students on an exempt status. For specific recruiting policies of the individual schools, the prospective student is encouraged to read the local recruiting bulletins and recruiting brochures published by the aeronautical institutes.

Some prospective students and parents are afraid to apply because they are concerned about the strict requirements on political background and physical conditions. These concerns are unfounded. The aeronautical institutes are conventional higher institutions; they are not military schools. The admission standards are strictly based on the recruiting guidelines

established by the State Education Commission for conventional higher institutions; there are no other special requirements. As a rule, the aeronautical institutes will give preference to students who have a genuine interest in the aviation industry or to model-airplane lovers with outstanding academic records.

In closing, we want to extend our hearty welcome to the youths of this country to join the aeronautical institutes and to contribute their skills and talents for China's aviation industry and for the cause of socialistic modernization.

#### Air Force Flight School

The Air Force Flight School under the jurisdiction of the People's Liberation Army is a military school for training flight officers. Over the past 3 decades, the school has trained a large number of flight personnel and military commanders for the air force units; they have made significant contributions to the protection of China's airspace and to China's aviation industry. The school's educational policy is "to achieve modernization, to face the outside world, and to look toward the future"; its goal is to give each flight cadet a solid background in modern aeronautical theory and basic flight skills. Each graduate from the flight school is expected to be a flight officer with high ideals, high integrity and an open mind; he is also expected to be knowledgeable; highly skilled, highly disciplined, perseverant, and physically strong.

The school has a strong team of faculty members with many years of teaching experience. It also has completed facilities designed for teaching, working, living and athletic activities; thus it provides an excellent environment for training future military officers.

The Air Force Flight School as a 4-year system divided into two stages: basic flight training and specialized technical training. New students must first complete courses and training at the Air Force Basic Flight Training School.

During basic training, the student is required to take military, political, cultural, and physical education courses; he must also undergo rigorous military training. The courses include: military concept, military classification, military topography, principles of Marxism, history of the Chinese revolution, introduction to law, China's military tradition, history of air force development, higher mathematics, engineering mathematics, general physics, English, mechanical drawing, theoretical mechanics, strength of materials, engineering thermodynamics, electrical engineering, fundamentals of electronic circuits, principles of automatic control and micro-computers. These courses and military training give the students a good foundation in political ideology, military knowledge, cultural awareness, self-discipline as well as physical conditions; these are the basic qualities of a flight officer.

The specialized flight training lasts 2 years and 4 months; during this period, the student takes courses in aeronautical theory and political science, and undergoes a concentrated program of specialized flight training.

The courses in aeronautical theory include: aerodynamics, flight dynamics, aerial navigation, aerial target shooting, aircraft structures, aircraft engines, aviation instrumentation, radio equipment, and aviation meteorology. The political courses include: socialistic development in China, world politics and economics, international relations, behavioral guidelines for the professional soldier, professional ethics for the pilot, defense economics, natural dialectics, psychology, and introduction to leadership science. In addition, the student must take lessons in special flight training on both simple and advanced trainers in order to complete the course work specified in the teaching manual.

Upon graduation, the student receives a bachelor's degree and the title of second company flight officer (a top student may become a first company flight officer); then he is assigned by the air force to combat units as pilot.

Flying is a sophisticated profession which involves both physical and mental labor; those choosing this profession must have certain special qualities. Therefore, the flight cadets accepted by the Air Force Flight School must also have the required political, physical, cultural, and psychological qualities in order to become flight officers. In 1987, the flight school will recruit 60 flight cadets from high schools located in the cities of Shenyang and Anshan in Liaoning Province, and the cities of Shijiazhuang and Tangshan in Hebei Province. The candidate cadet must be graduating high school senior between the ages of 16 and 19 (born between 1 January 1968 and 31 July 1971). The applicant must first pass a physical examination, a psychological examination and political background investigation before he is allowed to take the general state examination for higher education (including four categories: science, engineering, agriculture and medicine; the foreign language is limited to English). For those students whose scores exceed the flight schools' admission standard, the air force conducts an overall evaluation of their political, physical, cultural and psychological qualities before a final list of accepted cadres is announced. This list becomes official upon approval by the office of the provincial recruiting commission for higher institutions.

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PROJECTED PWR NUCLEAR FUEL CONSUMPTION

Chengdu HE DONGLI GONGCHENG [NUCLEAR POWER ENGINEERING] in Chinese Vol 8, No 2, Apr 87 pp 62-65, 79

[Article by Tian Sheng [3944 4141]; received 28 July 1985]

[Text] Abstract: This paper elaborates on problems relating to the area of pressurized-water reactor fuel consumption. With attention to different development models for nuclear power in China, projections are made for nuclear fuel consumption, separation work expenditure, and fissionable plutonium fuel accumulation.

I. Introduction

Accompanying China's rapid development in establishing modernized industries, energy requirements will be ever increasing. According to projections, in the year 2000, electricity generation must be  $5.0 \times 10^7 \text{ MW}\cdot\text{d}$  in order to be able to meet demand [1]. Hydroelectric, coal and oil, and nuclear power will be the three pillars of the Chinese electric power industry. At the end of this century, if China establishes 10,000MW of nuclear power plants, the amount of electricity they produce will constitute about 5 percent of the total electricity generated.

Today, nuclear power has developed into one of the world's technologically mature, safely reliable, and economically worthwhile energy sources. The installed capacity of pressurized-water reactor nuclear power plants constitutes over half of the total installed capacity of all nuclear power plants. From the present state of technology, industry, and the development of national power, Chinese industries have decided that pressurized-water reactors will serve as the major developed reactor type for nuclear power in this century. It is estimated that China's first nuclear power plant at Qinshan will be finished in 1988 and the Guangdong region is in the process of importing a pressurized-water reactor nuclear power plant. As China develops nuclear power, in the area of nuclear fuel, we certainly want to base ourselves on domestic resources which will require expanding the exploitation of uranium resources and doing post processing of spent fuel components to separate and recover their fissionable uranium and plutonium for recycling use [1].



In addition, since thermal reactor systems are only able to use  $^{235}\text{U}$  which is 0.7 percent of uranium reserves, only by developing fast [breeder] reactors can uranium resources be fully utilized. However, fast piles can only use plutonium fuel. Thus under the premise of China's selection of pressurized water piles as the first generation nuclear power reactor type, the accumulation of plutonium must rely on the development of pressurized-water reactor nuclear power plants.

Based on the above, this paper will elaborate on questions related to the areas of nuclear fuel consumption and separation work expenditure for pressurized-water reactor type nuclear power plants. With attention to different models for the development of nuclear power in China, projections are made for nuclear fuel consumption, separation work expenditure, and fissionable plutonium fuel accumulation as reference for the nuclear fuel industry and fast reactor development plans in China.

## II. Nuclear Fuel Consumption and Separation Work Expenditure of Pressurized-Water Reactor Type Nuclear Power Plants

Besides providing cheap electricity, pressurized-water reactor type nuclear power plants double as nuclear fuel conversion reactors, producing the fissionable plutonium fuel required by fast reactors. Consequently, these plants may be called "thermal-neutron converter reactors."

Based on the research results of reference [2], Table 1 gives data for various type fuel consumption and separation work expenditure in pressurized-water reactors. All the references to power in the table indicate electrical power. The various nuclear fuel consumption terms and separation work definitions are as follows:

### 1. Reactor direct specific charge

Definition

$$\text{Reactor direct specific charge} = \frac{Y'N}{\text{electric plant power (MW)}} \quad (1)$$

in which  $N$  is the uranium fuel with initial charge reactor core concentration  $x$ , tons;  $Y' = (x - x_t)/(x_n - x_t)$ ;  $x_n$ ,  $x_t$  respectively are the natural uranium concentration and the enriching plant end product concentration.

### 2. System specific input material

System indicates the fuel preprocessing system and the system specific input material refers to the amount of natural uranium which must be input to the system to generate 1MW of electrical power. Suppose the time that the nuclear fuel spends in the reactor is  $T_1$  years and the time spent outside the reactor (the time kept in the preprocessing system before being introduced into the reactor) is  $T_0$  years, then

$$\text{System specific input material} = \text{direct specific charge} (1 + T_0/T_1) \quad (2)$$



Table 1. Fuel Consumption and Separation Work Expenditure for Pressurized-Water Reactors

Term	Value
Reactor direct specific charge, tons(natural uranium)/MW	0.58(power ~ 600MW) 0.42(power ~ 900MW)
Net supplementary fuel, tons(natural uranium)/MW·a	0.12-0.14(power > 600MW) 0.14-0.18(power < 600MW)
Fissionable plutonium production efficiency(equivalent $^{239}\text{Pu}$ ) kg(fissionable plutonium)/MW·a	0.20
Fissionable isotope net consumption, kg(fissionable isotope)/MW·a	0.65-0.79(power > 600MW) 0.79-1.08(power < 600MW)
Separation work expended for direct specific charge, kg(separation work)/MW	313-382
Separation work expended for net supplementary fuel, kg(separation work)/MW	116-144

### 3. Net supplementary material

The net supplementary material is the value of the number of tons of fuel removed from the reactor for the production of 1MW·a of electrical energy (converted to the number of tons of natural uranium required) after deducting the number of tons of fuel which was reenriched to a concentration usable in a reactor from the  $^{235}\text{U}$  in the removed product (converted into the number of tons of natural uranium required). Refer to the first and second terms of the right side of formula (3).

### 4. Fissionable plutonium net production rate

Apart from the several hundred kilograms of  $^{244}\text{Pu}$  present in the natural world, all plutonium exists in manmade isotopes produced from  $^{238}\text{U}$  through nuclear conversion. In the spent fuel removed from reactors, plutonium constitutes 0.5-1.0 percent and of the plutonium isotopes so formed,  $^{239}\text{Pu}$  and  $^{241}\text{Pu}$  are fissionable isotopes. The quality and value of the plutonium is determined by the content of nonfissionable  $^{240}\text{Pu}$ .

The fissionable plutonium net production rate depends strongly on the average burn consumption level of the removed fuel, falling with deeper burn consumption. The dependence of the proportion of plutonium isotopes produced on burn consumption is secondary to the major dependence on the energy spectrum in the reactor. Only natural uranium graphite air cooled reactors and fast reactors are able to produce military grade plutonium (fissionable plutonium content over 90 percent). All other thermal reactors can only

produce industrial grade plutonium. In the plutonium produced by pressurized-water reactors about 70 percent is fissionable of which the  $^{239}\text{Pu}$  equivalent content is about 77 percent.

#### 5. Fissionable isotope net consumption

The fissionable isotope net consumption is the net consumed amount of fissionable isotope to produce  $1\text{MW}\cdot\text{a}$  electrical energy:

Fissionable isotope net consumption ( $\text{kg}/\text{MW}\cdot\text{a}$ ) =

$$\begin{aligned} &+ \text{supplementary fuel each year (kg natural uranium}/\text{MW}\cdot\text{a}) \times x_n \\ &- \text{amount of uranium in removed fuel (kg uranium}/\text{MW}\cdot\text{a}) \times (x_d - x_t)/(x - x_t) \\ &- \text{fissionable plutonium net production rate (kg}/\text{MW}\cdot\text{a}) \end{aligned} \quad (3)$$

in which  $\text{MW}\cdot\text{a}$  refers to electrical energy and  $x_d$  is the  $^{235}\text{U}$  concentration in the removed fuel.

Because this index summarizes the two factors of fissionable uranium isotope net consumption and the fissionable plutonium production, it is a major index of the final measure of fuel consumption.

#### 6. Separation work

The expended separation work  $SW$  (kg or tons) to enrich a unit mass (kg or tons) of enriched uranium is computed from the following formula:

$$\begin{aligned} SW = & (2x_p - 1) \ln \frac{x_p}{1 - x_p} + (Y - 1)(2x_t - 1) \ln \frac{x_t}{1 - x_t} \\ & - Y(2x_f - 1) \ln \frac{x_f}{1 - x_f} \end{aligned} \quad (4)$$

in which  $Y = (x_p - x_t)/(x_f - x_t)$ ;  $x_p$ ,  $x_t$ , and  $x_f$  respectively are the concentrations (percent by weight) of enriched uranium product, enriched plant tail material and enriched plant furnished material.

### III. Projections of Domestic Nuclear Fuel Requirements and Fissionable Plutonium Production

Assuming by the end of this century we construct pressurized-water reactor type nuclear power plants with a total installed capacity of around  $10,000\text{MW}$ , under the policy premise of nuclear fuel provision being entirely self-sufficient, we attempt here to project the amount of natural uranium and separation work required as well as the amount of fissionable plutonium accumulated to serve as a reference for domestic nuclear industry planning.

For this purpose we make the following assumptions:

1. Suppose four total installed capacities for the end of this century: 6,300, 7,500, 9,600, and 11,400MW to serve as different development models of China's future in nuclear power and assume that they all separately go operational in the 10 years from 1991 to 2000.
2. Pressurized-water reactor fuel in the standard design has a full efficiency lifetime of 3 years in the reactor. Considering the practical load factors of a nuclear power plant assume the fuel spends 4 years in the reactor.
3. The direct specific charge is computed according to the average value of the data in Table 1.
4. When computing the separation work, the supplementary charge, reactor core fuel is considered at an average concentration of 2.45 percent (this is done in order to simplify the computations and introduces an error of only about 2 percent). The supplementary fuel concentration was taken at 3.1 percent and the fuel enriched mill tail material concentration is taken at 0.3 percent. The separation work is computed according to formula (4).
5. The  $^{235}\text{U}$  in the spent fuel for the time being does not participate in recycling in the pile.
6. When computing the system specific input material,  $T_1$  is taken as 4 years and  $T_0$  as 2 years. Aside from the initial charge and the first supplementary fuel for the piles constructed in 1991 and 1992, the system specific input product question is not considered.
7. The fissionable plutonium net production rate is taken from Table 1.

In addition, considering the production cycle from the mining of uranium ore to the refining of yellow cake and enriching of the fuel to the fuel element finishing production, under the above assumptions we computed the fuel input to the reactor for the appropriate year with respect to the required amount of natural uranium and separation work. The postulated necessary years for specific fuel inputs are given separately for the premises of 3 years and 2 years. Considering the cycle from reactor pile fuel removal, cooling storage, and transport to fuel post processing, under the previous assumptions we compute the accumulated amount of fissionable plutonium produced up to the year of fuel removal, supposing that it was obtained 3 years after the required specific fuel removal time.

Based on the above assumptions and explanations, Figures 1 to 3 give the projected values of the required amounts of natural uranium, separation work, and accumulated fissionable plutonium production. The curves numbered 1, 2, 3, 4, in these figures are the results when the total installed capacity of nuclear power plants at the end of this century is 6,300, 7,500, 9,600 and 11,400MW.

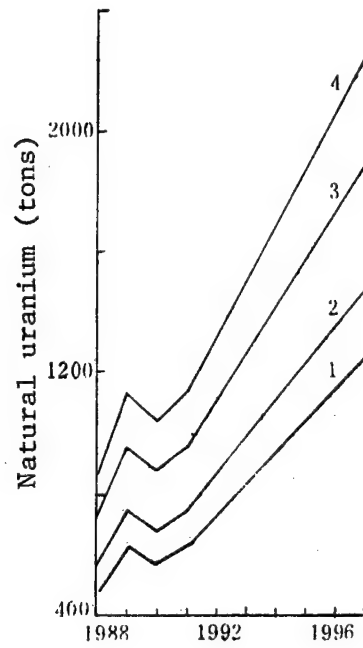


Figure 1. Projected Natural Uranium Requirement

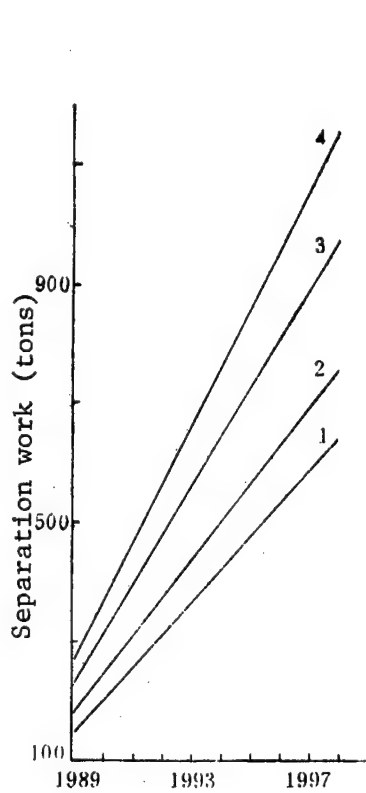


Figure 2. Projected Separation Work Required

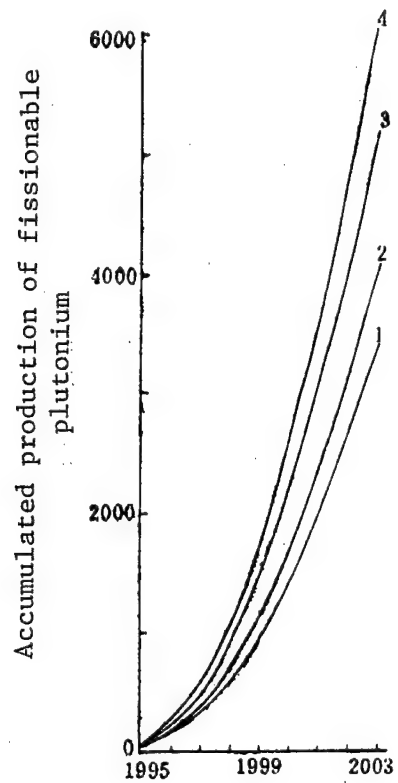


Figure 3. Projected Accumulated Production of Fissionable Plutonium

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12966/6091

CSO: 4008/70

## ON IDENTIFIABILITY OF DIFFUSION COEFFICIENT IN RIVER WATER QUALITY MODEL

Beijing YINGYONG SHUXUE XUEBAO [ACTA MATHEMATICAE APPLICATAE SINICA]  
in Chinese Vol 10 No 1, Jan 87 pp 24-32

[English abstract of article by Yu Wenhuan [0827 2429 3562] of Nankai University]

[Text] A river water quality model is described by a second order one-dimensional parabolic system whose diffusion coefficient is unknown. By means of water quality data observed at a point on a finite time interval, the author can identify the diffusion coefficient (a parameter). It is proven that the parameter is identifiable under some conditions, i.e., there exists a unique parameter to fit the model and the input-output model in an admissible parameter set. (Paper received 23 Jul 84; finalized 20 May 86.)

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CSO: 4009/1111

ON THE TRANSIC SPECIFIC PROPERTIES OF RESONANT PULSE JET FOR PIPELINE SYSTEM  
CONNECTED IN SERIES

Beijing YINGYONG SHUXUE XUEBAO [ACTA MATHEMATICAE APPLICATAE SINICA]  
in Chinese Vol 10 No 1, Jan 87 pp 81-90

[English abstract of article by Ren Fuyao [0117 4395 1031] of Fudan University]

[Text] In this paper the author deals with the transic specific properties of the resonant pulse jet for a pipeline system connected in series of theoretical fluids. The transitive functions of the continuous jet connected in parallel, the export specific properties of the pulse jet system and the resonant pulse jet system are given. (Paper received 18 Oct 84.)

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CSO: 4009/1111

## POWERFUL PICOSECOND ULTRAVIOLET LASER OUTPUT AT 354.7 NANOMETERS

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 14 No 2, 20 Feb 87 pp 86-88, 85

[Article by Dong Jingyuan [5516 2529 0337], Zhao Qingchun [6392 1987 2504], Qian Linxing [6929 2651 5281] and He Huijuan [0149 1979 1227] of Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Abstract] Frequency doubling and mixing of an active and passive mode-locked YAG laser have been accomplished using two types of KDP crystals. When the incident laser power density on the crystal is  $1.27 \text{ GW/cm}^2$ , stable UV laser output at 354.7 nm was realized with a pulse duration of 32 ps, peak power 30 MW, average power 60 mW and pulse repetition of 20 Hz. As used by the authors, the laser system is shown in the following figure:

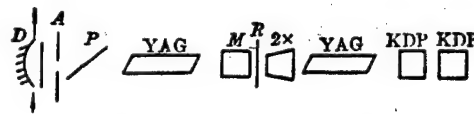


Figure 1. Triple Frequency System of Pulse Repetition Frequency ps Laser

Legend: D. Box of flowing dye with cavity mirror; A. Diaphragm aperture;  
P. Polarizer; M. Modulator; R. Output cavity mirror;  
2 x. Beam splitting mirror.

The four other figures show triple frequency KDP crystal and its layout along the incident polarization direction, 354.7 nm sequential pulse duration, a setup to measure pulse duration, and the pulse duration recorded by a camera for BWS-5K streaks. One table lists KDP parameters. The paper was received for publication on 21 January 1986.

10424/8309  
CSO: 4009/47



# A MODE-LOCKED RUBY LASER WITH CHLOROPHYLL d AS SATURABLE ABSORBER

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 14 No 2, 20 Feb 87 pp 89-91, 95

[Article by Liu Yixian [0491 0001 0341] and Li Fuming [2621 1381 6900] of Department of Physics, Fudan University]

[Abstract] An arrangement for a passively mode-locked ruby laser with chlorophyll d as saturable absorber and the experimental results are reported. The shortest pulse duration of about 1.5 ps was measured by the TPF method. Used by the authors, an experimental setup of the conventional passively mode-locked laser is shown in the following figure.

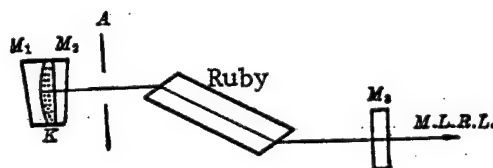


Figure 1. Experimental Arrangement of a Passively Mode-locked Ruby Laser

Five other figures show the absorption spectrum of chlorophyll d in anhydrous ethanol, pulse sequential waveform outputted by the laser, the TPF locus while chlorophyll d is used as the absorber, and the TPF measurement setup and the measured correlation-function curve in the TPF photoelectric method. One table lists the relationship between theoretical pulse duration and temperature, and the corresponding limiting ruby pulse duration.

Yang Shanyuan [2799 0810 0337] of the Shanghai Institute of Plant Physiology, Chinese Academy of Sciences, furnished the chlorophyll d for the research; Zhi Dehong [5365 1795 7703] of Fudan University assisted in data processing. The authors are grateful to the above mentioned. The paper was received for publication on 31 October 1985.

10424/8309

CSO: 4009/47

# MEASURING STABILITY OF OPTICAL REFERENCE CAVITIES BY ANALYZING POLARIZATION SPECTRUM

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 14 No 2, 20 Feb 87 pp 105-108

[Article by Shao Zhongxing [6730 0022 5281] and Xu Fengming [6079 7685 7686] of Changchun Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Abstract] A polarization method for measuring the stability of optical reference cavities is reported. Measurement with an  $I_2$  stabilized He-Ne laser (stability is less than  $2 \times 10^{-10}$ ) and sampling time of 0.01 second confirmed that the stability of a test cavity was about  $1.3 \times 10^{-9}$ . Please refer to the following figure for the experimental setup.

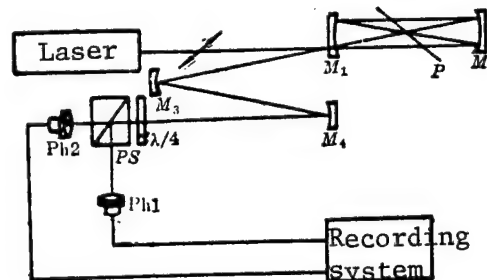


Figure 1. Experimental Arrangement for Measuring (With Polarization Method) Stability of Optical Reference Cavity

Seven other figures show the function and calculation curves, experimental curves, pulse curve, stability test result, and signal amplitude of the measured cavity mode. The paper was received for publication on 7 October 1985.

10424/8309  
CSO: 4009/47

## SINGLE-PERIODIC MULTILAYER GRATING LASER DOPPLER VIBROMETER

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 14 No 2,  
20 Feb 87 pp 109-112

[Article by Wang Baocheng [3769 1405 2052] and Lu Jiechi [4151 2638 2170] of  
Dalian Engineering College]

[Abstract] By means of single periodic multilayer phase grating and based on the revolving field principle for velocity direction discrimination, a laser Doppler vibrometer system was developed; the system provides a potential method of velocity measurement. The theoretical analysis and experimental results of using the system are presented. The following figure shows a single periodic multilayer grating moving at velocity  $V$ .

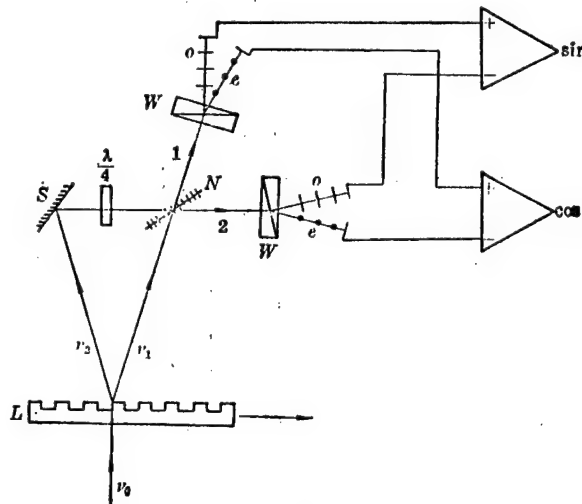
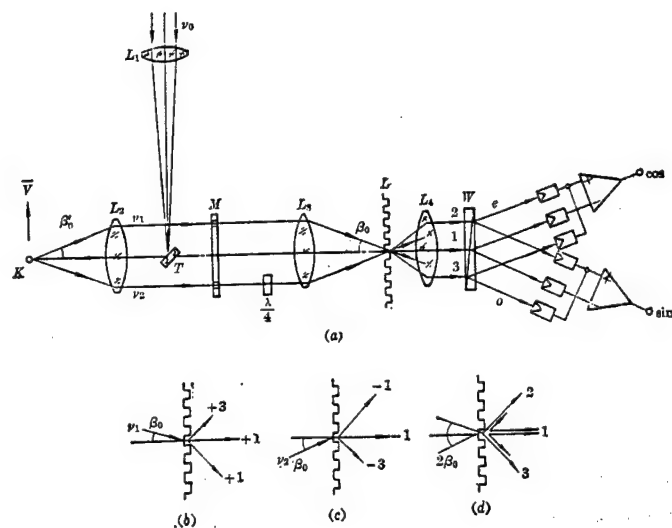
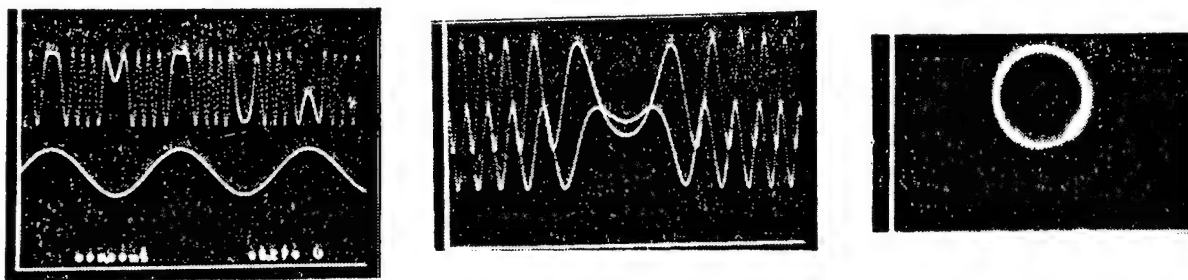


图 1

As shown in the following figure, the linearly polarized light (as output from the He-Ne laser) is beamed to aluminum plate K through lens L.



In the three following figures [Fig. 2(b), (c) and (d)], positive and negative signs, and numbers serve to express an increase or decrease in frequency, and the diffraction levels.



Two other figures show Doppler signal and the translation of the component to be measured, and two-channel Doppler signals. The paper was received for publication on 5 December 1985.

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CS0: 4009/47

GAS DYNAMIC CHARACTERISTICS IN FAST AXIAL FLOW CO<sub>2</sub> LASER

Shanghai YINGYONG JIGUANG [APPLIED LASER] in Chinese Vol 7 No 2, Apr 87  
pp 54-56

[Abstract of article by An Chengwu [1344 2110 2976], Li Shimin [2621 6624 3046] and Li Zaiguang [2621 0375 0342] of the Laser Institute, Huazhong University of Science and Technology, Wuhan]

[Text] The properties of gas flow parameters in fast axial flow CO<sub>2</sub> lasers are studied theoretically for the purpose of proposing pneumatic measures to improve laser performance. Through numerical analysis, relationships between speed, temperature, total temperature, total pressure, static pressure, and density are derived. With increasing discharge power, the gas velocity in the discharge tube increases rapidly while its density falls quickly. Gas pressure drops off and temperature increases right up to the blower entrance. Since for a given fast axial flow laser pneumatic system it was found that the rate of temperature increase in the gas is faster than the increase in discharge injection power, improving the blower's performance in cooling the gas flow has an important positive effect, enhancing laser output.

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CSO: 4009/56

OPERATIONAL PERFORMANCE OF REPETITIVE KrF, XeCl EXCIMER LASERS

Shanghai YINGYONG JIGUANG [APPLIED LASER] in Chinese Vol 7 No 2, Apr 87  
pp 76-78

[Abstract of article by Yuan Cailai [5913 2088 0171], Yue Yaokang [2867 5069 1660] and Jiang Baocai [5592 1405 6299] of Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] The output characteristics of a KrF, XeCl excimer laser with gas longitudinal cycling are discussed. Results of the study show that the single pulse energy is larger than 200mJ with a repetition rate of 10Hz, and an average output power greater than 1W. The divergence angle is  $2 \times 5$  mrad and with over one hour of operation at 10Hz, the power stability is  $\pm 10$  percent. the laser life span is  $1.26 \times 10^5$  times.

12966  
CSO: 4009/56

INVESTIGATION OF TWO LASER BEAM COUPLING AND AMPLIFICATION IN Ce-DOPED SBN  
SINGLE CRYSTALS

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 14 No 4,  
20 Apr 87 pp 220-224

[English abstract of article by Xu Huaifang [1776 2037 2455], et al., of the  
Physics Department, Shanghai Teachers' University; and He Xuemei [0149 7185  
2734], et al., of Shanghai Institute of Ceramics, Chinese Academy of Sciences]

[Text] The experiment in which a laser beam was amplified by another after  
both beams crossed a Ce-doped (0.1 Wt percent) strontium barium niobate  
( $\text{Ba}_x\text{Sr}_{1-x}\text{Nb}_2\text{O}_6$  or SBN,  $x = 0.48$ ) crystal is reported and preliminary theoret-  
ical analysis is given. The density of mobile charges in Ce-SBN is calculated  
to be  $4.5 \times 10^{16} \text{ cm}^{-3}$  (at ambient temperature). The sign of mobile charges  
determined from the energy flow direction is positive. Couplings at different  
polarizations, different wavelengths and different doping amounts are compared.

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CSO: 4009/65

STUDY OF  $\text{KPrP}_4\text{O}_{12}$  CRYSTALS

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 14 No 4,  
20 Apr 87 pp 229-231

[English abstract of article by Hong Guangyan [3163 1639 6056], et al., of  
Changchun Institute of Applied Chemistry, Chinese Academy of Sciences]

[Text]  $\text{KPrP}_4\text{O}_{12}$  crystals were grown by the evaporation solution method. The growth conditions were studied and some better crystals were obtained. Chemical analysis and X-ray diffraction patterns proved that the crystals grown were  $\text{KPrP}_4\text{O}_{12}$ . The crystal structure of  $\text{KPrP}_4\text{O}_{12}$  can be divided into two types, and their infrared, absorption and fluorescence spectra have been determined. This may prove to be a novel laser crystal.

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CSO: 4009/65



THEORETICAL ANALYSIS OF PULSED LASER DISCHARGE CIRCUIT WITH RAIL GAP

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 14 No 4,  
20 Apr 87 pp 232-236

[English abstract of article by Lou Qihong [2869 4388 3163], et al., of  
Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] Rail gap is one of the most important techniques for obtaining large volume uniform discharge at high gas pressure. In this paper, a pulsed laser discharge circuit with a rail gap is analyzed theoretically. According to the self breakdown, voltages of the rail gap at different gas pressures, a computer code is used to calculate the discharge characteristics and laser output for different discharge voltages and repetition rates. The calculated results are in good agreement with the experimental data.

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CSO: 4009/65

STEADY-STATE CHARACTERISTIC ANALYSIS FOR BISTABLE LASER DIODES

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 14 No 5,  
20 May 87 pp 262-266

[English abstract of article by Zhong Lichen [6988 4539 2525], et al., of the  
Department of Radio and Electronics, Qinghua University, Beijing]

[Text] In this paper the authors analyze the steady-state characteristics of a bistable semiconductor laser diode (BILD). A simple model for the optical output of BILD is obtained using nonlinear rate equations for the electron and photon densities. This model emphasizes the physical mechanisms and parameters responsible for the bistability, gives the state equation and explains the main features of BILD. Bistability with a very large hysteresis in  $P_0$ - $P_i$  characteristics is an outstanding feature of BILD.

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CSO: 4009/66

GAS FLOW EFFECTS IN PULSE AVALANCHE DISCHARGE XeCl EXCIMER LASERS

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 14 No 5,  
20 May 87 pp 267-271

[English abstract of article by Qi Jianping [4359 1696 1627], et al., of  
Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences,  
Shanghai]

[Text] The gas velocity of a high pressure transverse flow excimer laser was  
measured with a laser interferometer. The effects of gas heating caused by  
gas discharge on the laser output power were analyzed theoretically. The  
maximum output power of 18 W at 16 pps was obtained with uniform transverse  
flow technology.

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CSO: 4009/66

REFLECTIVITY CHARACTERISTIC OF RESONANCE ACTIVE MEDIUM

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 14 No 5,  
20 May 87 pp 275-278

[English abstract of article by Fan Junying [5400 0193 4481] of Shanghai  
Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai]

[Text] An anomalous characteristic of reflectivity of a resonance active medium is analyzed theoretically based on the treatment of nonlinear optical susceptibility of a two-level atomic system. The calculation curves of the relationship between  $R$  and  $AA^*$  and  $R$  and  $\delta$  ( $A$  is the amplitude of the electric field of the laser beam, while  $\delta$  is the dimensionless detuning of the center line of the atomic system about the center frequency  $\omega_0$ ) are obtained for the laser active medium as a Nd:YAG crystal. It is shown that there is still dependence of  $R$  on  $AA^*$ , even at a very low intensity of  $AA^* \sim 10^{-4}$ .

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CSO: 4009/66

INFRARED FLUORESCENCE FROM LASER INDUCED SENSITIZED REACTION OF  $\text{SF}_6$ - $\text{UF}_6$ - $\text{H}_2$  SYSTEM

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 14 No 5, 20 May 87 pp 279-282, 274

[English abstract of article by He Zhiqiang [0149 1807 1730], et al., of the Laser Chemistry Laboratory, Fudan University, Shanghai]

[Text] Infrared fluorescence from the sensitized reaction in the  $\text{SF}_6$ - $\text{UF}_6$ - $\text{H}_2$  system induced by the  $10.6\text{ }\mu\text{m}$  P(24) line of a pulsed  $\text{CO}_2$  laser is investigated. The time resolved IR fluorescence of vibrationally excited  $\text{HF}^*$  is measured with an InSb photovoltaic detector and is compared with that from the  $\text{SF}_6$ - $\text{H}_2$  system under similar experimental conditions. The authors' results show a linear dependence of fluorescence intensity with laser fluence. The time resolved IR fluorescence of  $\text{HF}^*$  is dependent on the partial pressure of  $\text{UF}_6$ . The fluorescence intensity obeys the single exponential decay at lower  $P_{\text{UF}_6}$ , but non-single exponential decay is observed at higher  $P_{\text{UF}_6}$ . The time dependence of the  $\text{HF}^*$  fluorescence intensity is explained with the infrared photo-sensitized reaction mechanism of the  $\text{SF}_6$ - $\text{UF}_6$ - $\text{H}_2$  system.

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CSO: 4009/66

INVESTIGATION OF DEPENDENCE OF PHOTOACOUSTIC SIGNAL ON OPTICAL BEAM POSITION  
AT SAMPLES

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 14 No 5,  
20 May 87 pp 292-294, 301

[English abstract of article by Wang Guifen [3769 2710 5358], et al., of the  
Department of Physics, Nankai University, Tianjin]

[Text] The authors used piezoelectric ceramics as the photoacoustic detector and investigated the dependence of the photoacoustic signal on the optical beam position at samples yielded by the optical absorption of the crystal Si at 10.6  $\mu\text{m}$ . The experimental results demonstrate that the photoacoustic signal was maximum when the optical beam was located at the center of the sample. When the optical beam scanned along the diameter of the circular sample, the photoacoustic signals decreased gradually as the distance between the position and the center of the sample increased. The measured results are in good agreement with those of the theoretical calculations.

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CSO: 4009/66

BIS-THIOUREA CADMIUM CHLORIDE (BTCC)--A NOVEL NONLINEAR OPTICAL CRYSTAL OF ORGANOMETALLIC COMPLEX

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 14 No 5, 20 May 87 pp 302-308

[English abstract of article by Xing Guangcai [6717 0342 1752], et al., of the Institute of Crystal Materials, Shandong University, Jinan]

[Text] According to the idea of "combining the inorganic distorted polyhedra with asymmetric conjugate organic molecules," preliminary exploratory results of nonlinear optical material of an organometallic complex are reported for the first time. A comprehensive study was carried out on the growth and linear and nonlinear optical properties of the typical material--bis-thiourea cadmium chloride (BTCC). The results show that the organometallic complex is a source of promising nonlinear optical material.

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CSO: 4009/66

ON NONLINEAR PROPERTIES OF PHOTOMAGNETOELECTRIC EFFECT IN SEMICONDUCTORS

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 5, May 87  
pp 547-554

[English abstract of article by Luo Shiyu [5012 6108 5940], et al., of  
Chongqing Institute of Communications; Liu Zengrong [0491 2582 2837] of  
Anhui University]

[Text] The continuity equation of charge carriers through a semiconductor has been reduced to a second order nonlinear differential equation using the injection-level-dependent lifetime which was derived from Shockley-Read statistics. The general solution was found using a two-parameter perturbation method. The PME short-circuit current  $I_{sc}$  and photoconductance  $\Delta G$  in a semiconductor are calculated in the second order approximation. The nonlinear properties of the photomagnetolectric effect in the case of large signals are disclosed, with the experimental results better than expected from the theory.

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CSO: 4009/67



ELECTRONIC STRUCTURES OF MIXED CHALCOGENIDE PAIRS IN Si

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 5, May 87  
pp 555-561

[English abstract of article by Gu Yiming [7357 0001 7686], et al., of the  
Department of Physics, University of Science and Technology of China, Hefei]

[Text] Using Green's function method with a tight binding Hamiltonian, the electronic structures of the ground states of  $S^0/Se^0$ ,  $S^0/Te^0$  and  $Se^0/Te^0$  mixed pairs in Si are investigated. Two  $A_1$  symmetrical states are introduced by the mixed pairs, with the bonding  $A_1$  state higher than the antibonding  $A_1$  state. The numerical results of the energy levels of mixed pairs are obtained, which are in agreement with the experimental observations. It looks likely that the unidentified shallower energy levels ( $S^0/Se^0(X_1)$ ,  $S^0/Te^0(X_1)$ ,  $Se^0/Te^0(X_1)$ ...) are not introduced by the mixed pairs with other non-nearest positions. The authors note that the transfer direction of the s wavefunction between two different defect atoms in Si is reversed when compared with that of the ordinary diatomic molecule. The physical reasons are discussed.

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CSO: 4009/67

STUDY OF SPECTRAL CHARACTERISTICS OF  $\text{YGG:Cr}^{3+}$  CRYSTAL

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 5, May 87  
pp 584-590

[English abstract of article by Gao Wenbin [7559 2429 2430], et al., of Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Hefei]

[Text] The spectral characteristics of a  $\text{YGG:Cr}^{3+}$  crystal were investigated experimentally. The absorption spectrum at 300 K and fluorescence spectra at 10 K, 133 K and 300 K are presented. The fluorescence lifetime, nonradiative probability and radiative quantum efficiency as the functions of temperature are also presented. Based on the absorption and fluorescence spectra, with the perturbation of a  $C_{3i}(S_6)$  low symmetry field, the individual substates resulting from the splitting of the  $\text{Cr}^{3+} {}^2T_1$  state in the YGG host and the location of the R line due to  ${}^2A_2 \leftrightarrow E$  zero phonon transition are determined.

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CSO: 4009/67

SMALL-ANGLE X-RAY DIFFRACTION STUDY OF AMORPHOUS MULTILAYER AND SINGLE LAYER THIN FILMS

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 5, May 87  
pp 591-598

[English abstract of article by Wu Zhiqiang [0702 1807 1730], et al., of the Department of Physics, University of Science and Technology of China, Hefei; Wang Changsui [3769 2490 3606], et al., of the Open Laboratory of Structure Analysis, University of Science and Technology of China, Hefei]

[Text] A small-angle X-ray diffraction study of amorphous  $a\text{-Si:H}/(a\text{-SiN}_x\text{:H})$  periodical multilayer thin films and some single layer films has been undertaken. A number of satellite peaks were found in the lower side of Bragg diffraction peaks of multilayer thin films with a smaller number of periods. A number of diffraction peaks were also found for the small-angle diffraction of single layer films. The authors present a simple formula for calculating the X-ray diffraction intensity of multilayer and single layer films. A satisfactory explanation of the experimental results has been obtained. Therefore, a simple method for measuring the total thickness of both multilayer and single layer thin films is presented.

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CSO: 4009/67

ELASTIC GREEN'S FUNCTION OF ANISOTROPIC CUBIC CRYSTALS AND ITS APPLICATIONS

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 5, May 87  
pp 599-612

[English abstract of article by Yang Zhengju [2799 2973 5282] of the Institute of Solid State Physics, Department of Physics, Nanjing University]

[Text] The series expansion of elastic Green's function of an anisotropic cubic crystal is calculated and the expansion coefficients are given under the second order approximation. Applying the results to an elastic dipole model, one obtains the expressions of elastic displacement field due to a symmetrical center and the interaction between two symmetrical centers. For strongly anisotropic cubic crystals, such as K and Cu, it is surprising that the numerical results of the displacement field of the symmetrical center and the interaction between them are basically the same as those obtained using lattice statics, which is based on the discrete nature of the lattice, although the convergence is not very satisfactory. This seems to indicate that the author's analytical expression of the elastic Green's function leads to a simple and easy method, which can generally be used to describe some mechanical behavior of cubic crystals correctly.

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CSO: 4009/67

THEORY OF SUPERCONDUCTIVITY IN KONDO LATTICE

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 5, May 87  
pp 613-622

[English abstract of article by Xu Jihai [1776 4949 3189], et al., of the  
Institute of Physics, Chinese Academy of Sciences; Su Zhaobing [5685 5128  
0393] of the Institute of Theoretical Physics, Chinese Academy of Sciences]

[Text] S-wave and P-wave superconductivity in the Kondo lattice is theoretical-  
ly studied in connection with heavy-fermion superconductivity (HFS). The  
hybridization between the f-electron and conduction electron is investigated  
consistently and the corresponding quantities have been calculated in detail  
in the generalized Nambu formalism. It is shown that if one thinks f-electrons  
are responsible for superconductivity for the S-wave paired state, the super-  
conducting transition temperature is in agreement with that of Tachiki, et al.,  
but the specific heat jump is not--the authors' results are more appropriate.  
For the P-wave paired state, the HFSs described by a Kondo lattice model are  
essentially almost localized Fermi superfluids with a small modification. The  
effects of impurities on S- and P-wave paired states have been studied in  
detail respectively, and the conditions of the appearance of gapless super-  
conductivity have been obtained for each case.

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COLLISION CROSS-SECTIONS AND TRANSPORT COEFFICIENTS IN INDUCTIVELY COUPLED ARGON PLASMA

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 5, May 87  
pp 630-639

[English abstract of article by Huang Mao [7806 4243] of the Department of Physics, Branch School of Beijing University; Liu Keling [0491 0344 3781] of the Institute of Chemical Metallurgy, Chinese Academy of Sciences]

[Text] Collision cross-sections as well as electrical conductivity, thermal conductivity, diffusion coefficients and viscosity coefficients of an inductively coupled argon plasma are calculated. The results indicate that the thermal conduction process plays an important role in energy transfer, while ambipolar diffusion leads to a much higher electron density in the cool plasma regions when compared with the value predicted by local thermal equilibrium. More significantly, both three body recombination and superelastic collision give rise to the creation of a large number of energetic electrons in the cool plasma regions. Such a deviation of electron velocity distribution from a Maxwellian may be of special significance for the excitation mechanism of the plasma used as an emission spectroscopic source.

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FINE STRUCTURES OF SECOND HARMONIC TIME RESOLVED SPECTRUM IN LASER PLASMAS

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 5, May 87  
pp 655-659

[English abstract of article by Gu Min [7357 2404], et al., of Shanghai  
Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] This paper presents the time resolved spectrum with high temporal resolution ( $\sim 10$  ps) and spectral resolution ( $\sim 0.6$  Å) of  $2\omega_0$  harmonic emission at  $90^\circ$  to the laser axis. It is shown experimentally that the primary peak and the secondary peak of the  $2\omega_0$  harmonic are actually composed of many fine and bright fringes with intervals of about  $1.5\sim 3$  Å directly connected with atomic weight. Analysis and discussion of these are given.

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RESEARCH ON STABILITY OF HIGH-PRESSURE DISCHARGE EXCITED XeCl EXCIMER LASER

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 5, May 87  
pp 668-672

[English abstract of article by Lou Qihong [2869 4388 3163] of Shanghai  
Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] The stability of the high-pressure discharge excited XeCl excimer laser is related to the concentration of halogen donor HCl. In this paper, a theoretical analysis of the equation for continuity of the electrons in the discharge plasma predicts that the duration of the uniform phase should vary as the inverse square root of the HCl concentration. This prediction is in good agreement with experimental results obtained from a X-ray pre-ionized PFN pumped XeCl excimer laser.

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REPORT ANALYZES JILIN MOUNTAIN ECOLOGY, ECONOMY

Beijing DILI KEXUE [SCIENTIA GEOGRAPHICA SINICA] in Chinese Vol 7, No 1, 1987  
pp 65-72

[Article by Bai Xiaoming [4101 2400 2494] and Cao Zhe [2580 0811], Institute of Environmental Protection, Changchun, Jilin Province: "Analysis and Regulatory Study of the Ecological and Economic Systems in the Changbai Mountain Region"]

[Summary] 1. Ecological and Economic Situation in the Changbai Mountain Region (CMR)

The CMR is located along the Korean border, in southeastern Jilin Province. The area in question is thought to be about 70,000 square km.

The authors stress the importance of looking at the region from both the ecological and the economic points of view. The resources here are operated primarily by the Ministry of Forestry, which calls the area the "Changbai mountain region agricultural and forested ecological-economic system."

A. Structure of the CMR ecological-economic system

1. Land use structures
2. Biological varieties
3. Economic and energy input/output structures
4. Output value structures

"This set of structures can basically manifest the uses and functions interwoven between natural and economic reproduction, as well as the mutual influence between the various structures and the relations between their mutual uses."

1. Land use structures

Land use is restricted by the condition of land resources. Land cultivation has exceeded normal bounds and has moved onto slopes and into other undesirable areas.

## 2. Biological varieties

There are two subsystems here: agricultural and forested, both constituting the primary production among biological varieties. Animals are secondary producers.

## 3. Input/output structures

There are direct economic results and indirect ecological results. The rate of energy transformation is a key element.

## 4. Output value structures

These are the gross value of all products generated from agriculture and forestry. The proportions of the five areas of agriculture, forestry, animal husbandry, byproducts, and fishing for 1984 were: 47.5 percent, 33.2 percent, 7.6 percent, 10.8 percent, and 0.9 percent, respectively.

## B. Functional analysis of the CMR ecological-economic system

1. Energy flow: For the entire system, the rate of energy transformation is in the mid-range for areas throughout the country. There is much loss of forested land, which then becomes grassland. Energy transformation rates are on the decline.

With effort, slopes could be restored to forested lands to strengthen the forest's ecological system.

Most of the agricultural energy is organic, but most of that is manpower and animal power, and almost none is compost. Seventy-five percent of organic matter is burned for fuel, with only 10-15 percent being returned to the soil as manure. Our goal would be to return 50 percent to the fields.

Grain and legume production is unstable, with too much reliance on chemical fertilizers.

2. Economic flow: The ecological and economic system structures of the region are not reasonable and their functions are incomplete. The attributes of system manifestation are not in a beneficial cycle.

## C. Problems with the CMR ecological-economic system

1. Land use is not reasonable, and not all industrial elements are evenly represented. From old habits, there is a continual conflict between land use and conservation: Too much land is being cultivated forestry emphasizes cutting, not replacement; grassland utilization is only about 35 percent of what is possible; 17.53 percent of the urbanized land is cultivated; and land use is too slanted toward cultivation, despite the region being basically forested mountain area.

2. There is serious erosion.

II. Artificial Regulation and Ways To Improve the Ecological and Economic Conditions in the CMR

A. More study of natural resources, to determine the proportion each industry should have.

B. Rational use of natural resources and development of commodity production.

C. Strict control of population growth, and development of varied resources. Need for more energy sources to discourage use of forest materials.

D. Perfection of laws and implementation of policies

12586/13104

CSO: 4008/2086

INVOLVEMENT OF DYNORPHIN IN ANTINOCICEPTION INDUCED BY INTRATHECAL INJECTION  
OF NEUROTENSIN IN RAT

Shanghai SHENGLI XUEBAO [ACTA PHYSIOLOGICA SINICA] in Chinese Vol 39 No 1,  
Feb 87 pp 19-25

[English abstract of article by Han Songping [7281 2646 1627] of the Department  
of Neurotransmitters, Beijing Institute of Neurosurgery; Xie Guoxi [6200 0948  
3886] of the Department of Physiology, Beijing Medical College]

[Text] Intrathecal injection of neurotensin (0.63-5  $\mu$ g) produced a dose-  
dependent analgesic effect in rats. This analgesic effect was antagonized  
by intrathecal injection of opioid antagonist naloxone (100  $\mu$ g) or anti-  
dynorphin IgG (20  $\mu$ g), but not by anti-enkephalin IgG or enkephalin degrading  
enzyme inhibitors bestatin, thiorphan and captopril. These results suggest  
that the antinociceptive effects induced by intrathecally administered neuro-  
tensin are mediated, at least in part, by dynorphin in the spinal cord of the  
rat.

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MOBILIZATION OF GRANULOCYTE-MACROPHAGE COLONY-FORMING CELL (CFU-GM) INTO PERIPHERAL BLOOD OF MOUSE BY CH. VIOLACEUM ENDOTOXIN

Shanghai SHENGLI XUEBAO [ACTA PHYSIOLOGICA SINICA] in Chinese Vol 39 No 1, Feb 87 pp 61-67

[English abstract of article by Zhang Jin [1728 6651], et al., of the Department of Radiation Medicine, Second Military Medical College, Shanghai]

[Text] Mobilization of CFU-GM from hematopoietic tissue into the circulation of mice was studied after intravenous injection of Ch. violaceum endotoxin. A single injection 25 µg dose of endotoxin appeared to produce about a two-fold increase in the CFU-GM per  $10^5$  MNC. The evaluation of CFU-GM/ $10^5$  MNC after endotoxin coincided with a decrease in the CFU-GM counts in the femur. The effect was greater as higher doses of endotoxin were injected. The spleen apparently acts as an organ which captures CFU-GM from the blood and not as a source for adding progenitor cells to the blood. Adrenalectomized mice did not show the increase of CFU-GM in the peripheral blood following endotoxin administration. This indicates that the mobilization of CFU-GM might be mediated by adrenal or cortical hormones.

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# COMPARISON OF HYBRIDIZATION PATTERNS OBTAINED FROM LABELED RNA WITH SOUTHERN BLOTTED VARIOUS RESTRICTION FRAGMENTS OF DNAs FROM RAT LIVER AND HEPATOMA

Shanghai SHIYAN SHENGWU XUEBAO [ACTA BIOLOGIAE EXPERIMENTALIS SINICA]  
in Chinese Vol 20 No 1, Mar 87 pp 47-52

[English abstract of article by Zhang Yuyan [1728 3768 4291], et al., of  
Shanghai Institute of Cell Biology, Chinese Academy of Sciences]

[Text] RNAs, including nuclear RNA, poly A<sup>+</sup> nuclear RNA, poly A<sup>-</sup> nuclear RNA, polysomal RNA and ribosomal RNA, were isolated from rat liver and rat hepatoma BERH-2 and labeled with Na<sup>125</sup>I,  $\gamma$ -<sup>32</sup>P-ATP or  $\alpha$ -<sup>32</sup>P-pCp respectively. The hybridization of the labeled probes with restricted DNA fragments was compared using the Southern blot technique. The hybridization bands of <sup>125</sup>I-labeled nuclear RNA with 15 kbp, 9 kbp and 2.4 kbp EcoR I fragments of rat liver DNA were stronger than those of corresponding bands of hepatoma DNA. When the 3' end or 5' end labeled probes were used instead of the <sup>125</sup>I-labeled probes, almost no hybridization band on the 15 kbp position of the hepatoma DNA was observed. However, the hybridization band on 2.0 kbp EcoR I fragment of hepatoma DNA was not observed in the corresponding site of the rat liver DNA. The hybridization of probes and 2.2 kbp BamH I fragment of rat liver was about three times higher than that of the corresponding DNA fragment of hepatoma. (Paper received 29 May 86.)

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INHIBITION AND REVERSION OF EPSTEIN-BARR VIRUS DNA REPLICATION IN H<sub>18</sub> CELL LINE

Shanghai SHIYAN SHENGWU XUEBAO [ACTA BIOLOGIAE EXPERIMENTALIS SINICA]  
in Chinese Vol 20 No 1, Mar 87 pp 53-60

[English abstract of article by Zhao Debiao [6392 1795 2871] of Shanghai  
Institute of Cell Biology, Chinese Academy of Sciences]

[Text] EBV genome equivalents per H<sub>18</sub> cell were estimated at about 207 by cell spot hybridization with EBV DNA BamH I-W fragments as probes and dropped abruptly after treatment with PAA. By day 11 after adding PAA at a concentration of 75  $\gamma$ /ml, the average number of EBV genome equivalents per cell decreased to 17, which was about 8 percent that of the untreated cell, and then remained at this level constantly under continuous treatment. The synthesis of EBV VCA was completely inhibited, but that of EA was not affected. Removal of the drug at day 3 allowed a recovery to 29 percent of the genome equivalent of the control value, and at day 40 it rose to 90 percent. Retreatment with n-butyrate after removal of PAA interfered significantly with this recovery. It is commonly believed that the replication of the EBV episome is mediated by host-cell DNA polymerase and the synthesis of viral linear DNA is mediated by the virus-induced PAA-sensitive DNA polymerase. Since n-butyrate can effectively prevent the host DNA replication apparatus, these results suggest that both the host and virus-induced DNA polymerase may play a role in the recovery of the EBV DNA content in H<sub>18</sub> cells after discontinuing PAA treatment. (Paper received 4 Jun 86; finalized 4 Sep 86.)

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## PNA-GLYCOPROTEIN PATTERNS OF CHICK RETINA DURING EMBRYO DEVELOPMENT

Shanghai SHIYAN SHENGWU XUEBAO [ACTA BIOLOGIAE EXPERIMENTALIS SINICA]  
in Chinese Vol 20 No 1, Mar 87 pp 61-69

[English abstract of article by Liu Li [0491 7812], et al., of Shanghai  
Institute of Cell Biology, Chinese Academy of Sciences]

[Text] In a previous study, using the FITC coupled peanut agglutinin (FITC-PNA) technique, the temporal and spatial patterns of the developmental chick retina were revealed. It has been found that the PNA binding sites appear first in the inner plexiform layer (IPL) of a 7-day-old embryo (E7) and outer plexiform layer (OPL) of E9 during early developmental stages of the embryo. The total protein patterns were revealed by two-dimensional microgel-electrophoresis, and the PNA binding glycoprotein patterns by the immuno-blotting technique. Using electrophoresis, quantitative as well as qualitative changes in the total protein of the retina of E4-E16 were observed. The specific spots of glycoproteins have not been found in the E4 retinas, while they do appear in E6 and then increase continuously. The proportion of spot numbers of glycoproteins in total proteins is higher in E6 than in E8-E16. Most of the increased glycoproteins are of middle molecular weights and in the neutral pH-range. The proportion of glycoprotein in the total protein of the optic nerve is about two-fold that of the retina at the same developmental stage, implying that the glycoproteins are mainly located on the cell's surface. In addition, the total protein patterns in the retina are more similar to those in the tectum than to those in the telencephalon.

These results indicate that the PNA-binding glycoprotein patterns are closely connected to the developmental stage. Glycoproteins may play an important role in the interaction between cells. Some functions of glycoproteins, such as cell adhesion and retino-tectum projection, are discussed. (Paper received 20 Jun 86; finalized 17 Sep 86.)

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## STUDIES OF CHARACTERISTICS OF GM-CFC IN PERIPHERAL BLOOD

Shanghai SHIYAN SHENGWU XUEBAO [ACTA BIOLOGIAE EXPERIMENTALIS SINICA]  
in Chinese Vol 20 No 1, Mar 87 pp 71-76

[English abstract of article by Ma Enpu [7456 1869 2528], et al., of the  
Institute of Radiation Medicine, Beijing]

[Text] The characteristics of proliferation of GM-CFC from different sources are compared using the semi-liquid agar culture technique. The results show that under normal physiological conditions the growth rate of GM-CFC colonies of blood origin is about 1/60 that from BM. Colony formation at the early stages of culture is about one day later than that of BM. The number of GM-CFC colonies increases with the increase in culture time. The rate of increase of GM-CFC colonies from the peripheral blood is 20 percent that from BM. The radiosensitivity, represented by  $D_0$ , is 0.34 Gy, which is lower than that of GM-CFC from BM (0.82 Gy). The number of colonies markedly increases following DS treatment, with the growth rate becoming 59 percent that of BM, so that the  $D_0$  value increases from 0.34 to 0.72 Gy. (Paper received 29 Apr 86; finalized 30 Sep 86.)

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MEMBRANE  $G_{M1}$  GANGLIOSIDE MEDIATED ENDOCYTOSIS OF CHOLERA TOXIN-HORSE RADISH PEROXIDASE COMPLEX (CT-HRP) IN CULTURED NEURONS

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in Chinese Vol 20 No 1, Mar 87 pp 89-94

[English abstract of article by Wu Gusheng [0702 6253 4141], et al., of  
Shanghai Brain Research Institute, Chinese Academy of Sciences]

[Text] In this experiment, cells dissociated from a newborn rat's cerebellum and cultured in vitro for 7-14 days were exposed to cholera toxin-horseradish peroxidase complex (CT-HRP) for 0.5-1 hour at 4°C. After being rinsed thoroughly, the cells were incubated at 36.5°C for 15 minutes to 3 hours to permit endocytosis of bound toxins on the membrane. Finally an electro-microscopic cytochemical reaction for HRP was achieved.

It was found that, at 4°C, CT-HRP became bound on membrane surfaces of neurons and some oligodendrocytes. This suggests that  $G_{M1}$  was distributed on the outer layer of the cell membrane. According to the density of reaction granules of CT-HRP under electron microscopy, it is shown that the concentration of  $G_{M1}$  on the neuronal membrane was higher than that on the oligodendrocyte.

Endocytosis of the bound CT-HRP into neuronal cytoplasm took place within 15 minutes after being incubated at 36.5°C. This endocytosis, called receptor  $G_{M1}$  mediated endocytosis (RME), proceeds frequently on dendrites as well as on cell bodies. Compared with the endocytosis of free HRP into neurons in which the endovesicles containing free HRP are fused into lysosomes to be degraded, the endovesicles containing  $G_{M1}$ -CT-HRP complex found their way primarily to the Golgi apparatus-Endoplasmic Reticulum-lysosomes system (GERL), which is functionally related to membrane recycling. If cells were incubated for 2 to 3 hours longer, the amount of CT-HRP bound on the neuronal membrane did not change significantly--lots of positive vesicles still aggregated in GERL while many others were found in the cytoplasm near the membrane and along the microtubules.

Most of the CT-HRP bound on the oligodendrocyte membrane was internalized when incubated for 15 minutes. A large number of endovesicles diffused in the cytoplasm. As the incubation time proceeded, the positive vesicles fused into lysosome.

The possible causes of the different forms of CT-HRP endocytosis in neurons and oligodendrocytes and their biological significance are discussed. (Paper received 24 Mar 86; finalized 3 Oct 86.)

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# ENDOCYTOSIS AND EMBRYONIC INDUCTION

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in Chinese Vol 20 No 1, Mar 87 pp 101-107

[English abstract of article by Zeng Mibai [2582 1736 4101], et al., of  
Shanghai Institute of Cell Biology, Chinese Academy of Sciences]

[Text] In the study of primary induction in amphibian embryos, transporting the inducing factors to the reactive cells has attracted much attention (Grunz and Staubach, 1979; Toivonen, 1979); however, this remains an unsolved problem.

An attempt has been made using in vitro experiments to solve this problem. Ectoderm explants of early gastrula of Cynops orientalis were treated with a crude extract of guinea pig bone marrow (BME) which has been proven to be a potent mesodermal inductor (Toivonen, 1953). After treatment with a concentration of 3,000 µg/ml for 12 hours, the ectoderm explants were fixed immediately in order to see the uptake of the inductive factors. Two series of control were carried out: (1) isolated ectoderm were treated with bovine serum albumen of the same concentration and for the same length of time; and (2) ectoderm was cultured for the same period without any treatment.

Ass the ectoderm explants were fixed with 2.5 percent glutaraldehyde, and both freeze-etching replicas and ultrathin sections were prepared and examined with Zeiss EM 109.

Observations of the freeze-etching replicas showed that endocytotic vesicles occurred frequently on the lateral membrane of the ectoderm cells treated with BME. They were quite numerous in some cells, while in others only a few could be found. On the lateral membrane of the ectoderm cells of the two control series, endocytotic vesicles were not observed.

In the ultrathin sections successive steps of the formation of the vesicles were recorded. By the characteristic feature of the presence of fine protrusions on the cytoplasmic surface of the vesicles, they were recognized as coated vesicles (Anderson and Kaplan, 1983). In cells with numerous coated vesicles, multi-vesicular bodies could usually be encountered. In the control series treated with bovine serum albumin and the series without any treatment, vesicles could be found only in a few cells.



It can be concluded that in the case of the induction of heterogeneous inducers, endocytosis by means of coated vesicles may play an important role. Although the inductive substance used was a crude extract, when compared with the control series and considering its inductive effect, it appears that the inductive factors have been taken into the cell through the process of endocytosis. Whether this phenomenon also occurs in vivo certainly deserves further investigation. (Paper received 20 Aug 86; finalized 19 Sep 86.)

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RELATIONSHIP BETWEEN CLONIDINE ANALGESIA AND CALCIUM CATION

Beijing YAOXUE XUEBAO [ACTA PHARMACEUTICA SINICA] in Chinese Vol 22 No 3,  
Mar 87 pp 170-173

[English abstract of article by Geng Wanping [5105 4111 1627], et al., of the  
Department of Pharmacology, Anhui Medical University, Hefei]

[Text] Using the radiant heat tail flick method and radioactive ligand binding test, the relationship between clonidine analgesia and the central calcium cation has been studied in rats. The clonidine analgesia (1 mg/kg, sc) was antagonized by  $\text{CaCl}_2$  (1  $\mu\text{mol/rat}$ , icv) and potentiated by EGTA (0.2  $\mu\text{mol/rat}$ , icv), a calcium chelator. Although pretreatment with verapamil (0.1  $\mu\text{mol/rat}$ , icv) showed no significant influence on the clonidine analgesia (1 mg/kg, sc), it partially reversed the antagonistic effect of the calcium. Calcium exhibited no inhibiting effect on [ $^3\text{H}$ ]-clonidine binding at concentrations of  $1 \times 10^{-7} \sim 1 \times 10^{-3}$  mol/L. The results suggest that the analgesic effect of clonidine is closely related to the calcium level of the tissue around the ventricles of the brain. The authors conclude that clonidine analgesia involves central calcium and that the calcium takes part in a physiologic-biochemical process which is shared by the activated receptors in the endogenous analgesic system.

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STUDIES OF SYNTHESIS OF 11  $\alpha$ -HYDROXY-QUINESTROL, 11  $\alpha$ -METHOXY-QUINESTROL AND THEIR ANTIFERTILITY ACTIVITY

Beijing YAOXUE XUEBAO [ACTA PHARMACEUTICA SINICA] in Chinese Vol 22 No 3, Mar 87 pp 191-195

[English abstract of article by Yang Yuwo [2799 3768 2053], et al., of the Department of Pharmaceutical Chemistry, Beijing Medical University]

[Text] Quinestrol was used as the lead compound for studies of new steroidal contraceptives for early pregnancy. The 11  $\alpha$ -hydroxyl and 11  $\alpha$ -methoxyl derivatives of quinestrol were synthesized.  $\Delta^9(11)$ -Estrone was treated with cyclopentyl bromide and potassium carbonate to form cyclopentyl ether (2). Hydroboration-oxidation of the ethylene ketal of (2) with  $B_2H_6-H_2O_2$  and chromatographic separation on silica gel produced 11  $\alpha$ -hydroxide (4) and a small amount of 11  $\beta$ -hydroxide and compound (3). (4) was methylated with NaH/DMSO and methyl iodide to produce (5). The 11  $\alpha$ -methoxy-quinestrol (7) was obtained when (5) was hydrolized with 5 percent hydrochloric acid and then ethynylated with ethynyl lithium. 11  $\alpha$ -hydroxy-quinestrol (9) was obtained when (4) was treated with 10 percent hydrochloric acid and then ethynylated with ethynyl lithium. The configurations of the target compounds and their respective intermediates have been confirmed by IR, MS,  $^1H$ NMR and elemental analysis. Preliminary pharmacological results on mice showed that 11  $\alpha$ -hydroxy and 11  $\alpha$ -methoxy derivatives of quinestrol did not possess significant anti-fertility activity.

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TECHNICAL CONTRACT LAW PROMULGATED

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[Text] Beijing, 24 Jun (XINHUA)--The People's Republic of China Technical Contract Law

Adopted by the 21st Session of the Standing Committee of the 6th National People's Congress on 23 June 1987

Chapter I General Principles

Article 1. This law is drawn up for promoting scientific and technological development, facilitating socialist modernization through science and technology, protecting the legitimate rights and interests of the relevant parties of technical contracts, and maintaining order on the technical market.

Article 2. This law applies to contracts signed between legal persons, between legal persons and citizens, and between citizens to ascertain their civil privileges and obligations in connection with technical development, technology transfer, technical consultation, and technical services. However, this law does not apply to contracts in which one party is a foreign enterprise, organization, or individual.

Article 3. A technical contract must be based on laws and regulations, and it must facilitate scientific and technological advancement and promote the application and popularization of scientific and technological achievements.

Article 4. The formulation of a technical contract must be based on the principles of voluntary participation, equality, mutual benefit, compensation, honesty, and trustworthiness.

Article 5. When a technical contract involves national security or major interests and must be classified, it shall be handled according to the relevant state regulations.

Article 6. A technical achievement accomplished in carrying out a unit's assignments, or by utilizing the unit's material and technical resources, is a professional technical achievement. The right to use and transfer the

professional technical achievement belongs to the unit, which has the authority to conclude a technical contract on that achievement. It should reward the individuals who accomplish that professional technical achievement on the basis of the returns earned from using or transferring that professional technical achievement.

The right to use and transfer a nonprofessional technical achievement belongs to the individual who accomplishes the technical achievement, and this individual has the right to conclude a technical contract on that nonprofessional technical achievement.

The application and granting of patents for professional or nonprofessional technical achievements are handled according to the relevant regulations prescribed in the Patent Law.

The individual who accomplishes a technical achievement is entitled to indicate on the relevant documents of his technical achievement that he is the one who accomplished the technical achievements. He is also entitled to awards and certificates of honor.

Article 7. For those significant, nonpatented technical achievements of the state units under the jurisdiction of responsible departments of the State Council and people's governments of various provinces, autonomous regions, and municipalities directly under the central government, they have the right to popularize and apply them at units designated by them in accordance with the needs of state or society. The users are responsible for keeping these technical achievements confidential. In accordance with a mutual agreement, the users must also pay for the use of the technical achievements. If an agreement cannot be reached, the organ making the decision shall determine a rational rate for the use.

The popularization and use of nonpatented technical achievements accomplished by collectively-owned units or individuals, which are significant to national or public interests, shall be handled according to the preceding provision after the State Council's approval has been obtained by the responsible departments under the State Council.

Article 8. Administrative organs handling technical contracts shall be designated by the State Council.

## Chapter II The Formulation, Fulfillment, Alternation, and Dissolution of a Technical Contract

Article 9. The formulation, change, and dissolution of a technical contract shall be in written form.

Article 10. A technical contract becomes effective after the parties concerned sign their names and affix their seals on it; if a contract has to be approved by a relevant organ according to state regulations, it becomes effective upon being approved.

Article 11. The parties concerned may agree upon the guarantees for a technical contract. A contract with a third party as guarantor becomes effective after the guarantor and the guarantees sign their names and affix their seals to the contract.

Article 12. The parties concerned shall agree upon the money, rewards, and the way they should be paid in the technical contract.

Article 13. The parties concerned may commission agents to make a technical contract. The appointors should give the power of attorney to their agents, and the agents shall make a contract in the name of their clients with the power they are authorized to exercise.

Article 14. Intermediary agencies that offer services to facilitate conclusion of technical contracts may ask for reasonable fees in line with relevant stipulations prescribed in this law and based on the principles of honesty and trustworthiness.

Article 15. Provisions of a technical contract should be formulated by parties concerned. Generally, the following should be included in a technical contract:

- (1) Name of project;
- (2) Contents, scope, and requirements of the goal;
- (3) Plan, schedule, deadline, venue, and methods to fulfill the contract;
- (4) Security of technical information and data;
- (5) Undertaking of risks and liabilities;
- (6) Ownership and sharing of technical achievements;
- (7) Standard and methods for acceptance;
- (8) Money or remuneration and terms of payment;
- (9) Computation of compensation for breach of contract or for losses;
- (10) Solution for settling disputes;
- (11) Explanation of terms and terminology.

Based on agreement reached by parties concerned, the following that pertains to fulfilling a contract may be incorporated into the contract: technical background information, feasibility study and technical appraisal report, project tasks and plan, technical criteria, technical standard, original design and industrial document, as well as blueprints, tables, data, and photographs.

Article 16. A technical contract concluded legally will have legal binding power. Parties should carry out their obligations specified in the contract, which neither party can alter or terminate without authorization.

Article 17. Breach of contract occurs when one party does not fulfill a technical contract or does not carry out its obligations in compliance with the contract. Under such circumstances, the other party is entitled to demand fulfillment of contract or take compensatory measures and is entitled to claim compensation for losses.

The liability of one party for breach of contract should be tantamount to the losses thus sustained by the other party, but should not exceed losses foreseen by the breaching party when concluding the contract.

Parties may stipulate in their contract a fixed amount of recompense for breach of contract or ways to compute compensation for losses caused by breach of contract.

The party that sustains losses due to breach of contract by the other party should immediately take appropriate measures to prevent aggravation of the losses; otherwise, he cannot claim compensation for aggravated portion of the losses.

Article 18. When both parties breach a technical contract, they should each bear their own liabilities.

Article 19. When one party is unable to fulfill its obligations in a technical contract due to instructions from a higher organ, it should compensate the other party's losses in accordance with stipulations of the contract or take other compensatory measures. The higher up organ will then take care of the losses it has thus sustained.

Article 20. Parties may be exempted from liabilities when unable to fulfill a technical contract due to force [word indistinct].

Article 21. A technical contract is null and void when:

- (1) It violates laws or regulations, or is detrimental to the interests of the state or the common interests of the society;
- (2) It illegally monopolizes technology, or hampers technical advancement;
- (3) It infringes upon other people's legitimate rights and interests;
- (4) It is concluded via fraudulent or coercive means.

An invalid contract has no legal binding power the moment it is concluded. Invalid portions of a contract will not affect the validity of the rest of the contract.

Article 22. Those who make technical contracts that violate laws or regulations or that damage the interests of the state or the common interests of the society and conduct illegal activities will be prosecuted for administrative or criminal responsibilities.

Article 23. Technical contracts can be altered or terminated upon agreement reached by parties concerned.

When altering or terminating a contract that has been approved by a relevant organ, permission should be solicited from that organ.

Article 24. One party is entitled to notify the other to terminate a technical contract when either of the following occurs that renders the fulfillment of the contract unnecessary or impossible:

- (1) The other party violates the contract;
- (2) Force majeure takes place;
- (3) The target technology of a technical development contract has been made public by other people.

Article 25. Alteration or termination of a technical contract will not affect the right of one party to claim compensation for losses.

Article 26. During the valid period of a technical contract, neither party can partially or totally transfer its rights and obligations to a third party without the consent of the other party.

### Chapter III Technical Development Contract

Article 27. A technical development contract is one made between parties for new techniques, products, technologies, or material, and systematic research and development thereof.

Technical development contracts can be divided into two categories: one of commission nature, one of cooperation nature.

Article 28. A development commission contract is one where one party commissions the research and development to the other.

The commissioning party is to:

- (1) Pay research and development expenses and remuneration as prescribed in the contract;
- (2) Provide technical information or original data as prescribed in the contract;
- (3) Accept research and development results at a specified date.



The commissioned party is to:

- (1) Draw up and implement research and development plans;
- (2) Complete its research and development on schedule and hand over its results. It should provide related technical information and essential technical instructions to help the commissioning party master the R&D results.

Article 29. The commissioning party, whose breach of contract results in disruption, delay, or failure of the research and development, should pay recompense for breach of contract or compensate for losses.

The commissioned party whose breach of contract causes disruption or delay of the research and development should pay recompense for breach of contract or compensate for losses, in addition to taking compensatory measures to fulfill the contract. If its breach of contract leads to failure of the research and development, it should return all or part of the research and development expenses and remuneration and pay recompense for breach of contract or compensate for losses.

Article 30. A development cooperation contract is one where parties cooperate in research and development.

The parties of a development cooperation contract are to:

- (1) Make investment as prescribed in the contract, including technical investment;
- (2) Share in the research and development as prescribed in the contract;
- (3) Coordinate with each other.

Article 31. Either party of a development cooperation contract, whose breach of contract results in disruption, delay, or failure of the research and development, should pay recompense for breach of contract or compensate for losses.

Article 32. In their technology transfer contract the principle for determining the ownership and sharing of the technological results derived from the fulfillment of a technology development contract is as follows:

- (1) Unless otherwise provided for in the contract, the patent application right for inventions resulting from development under commission shall belong to the party undertaking the research and development. The party commissioning the research and development may use the patent free of charge after the patent is granted to the commissioned party.

In case the party undertaking the research and development transfers its patent, the party commissioning the research and development has priority over others in receiving the transfer.

(2) Unless provided for otherwise in the contract, parties taking part in the cooperative research and development shall share the right to apply for patents for the inventions resulting from the cooperative research and development. In case a party transfers its share in the patent application right, the other party or parties have priority in receiving the transfer.

In case a party declares its intention to renounce its share in the patent application right, the other party or parties may apply for the patent. The party renouncing its share in the patent application right may use the patent free of charge.

A party or parties to cooperative research and development may not apply for a patent if the other party does not agree to apply for a patent.

(3) The method for dividing the profits and the right in using and transferring nonpatented technological results derived from research and development through cooperation or under commission shall be specified by the parties in the contract. In case this is not specified in the contract, the parties shall each have the right to use and transfer the results. However, the party undertaking research and development under commission shall not transfer the research and development results to a third party before the results are delivered to the commissioning party.

Article 33. The parties to a technology development contract shall specify in the contract the responsibility for the failure or partial failure in research and development caused by insurmountable technical difficulties that appear in the course of fulfilling the contract. In case this is not specified in the contract, the responsibility shall be equally shared by the parties.

The party shall promptly notify the other party and take appropriate measures to reduce losses in case it discovers the conditions described in the preceding section which may lead to research and development failure or partial failure; the party shall assume responsibility for the losses caused by its failure to promptly notify the other party and take appropriate measures.

#### Chapter IV Technology Transfer Contract

Article 34. A technology transfer contract is a contract made between parties concerning the transfer of patent rights, patent application rights, patent using permissions, and nonpatented technologies.

Article 35. A technology transfer contract may specify the scope for the use of patented and nonpatented technologies between the transferor and the transferee. However, the contract shall not contain provisions restructuring competition and development of technology.

Article 36. The relevant provisions of the Patent Law shall be observed in making contracts transferring patent rights and patent application rights.

Article 37. The primary obligations of a transferor in a contract for the transfer of permission to use a patent right are as follows:

- (1) The transferor shall permit the transferee to use the patent right within the scope agreed upon between the two parties in the contract;
- (2) The transferor shall provide relevant technological data and necessary guidance for the use of the patent right.

The primary obligations of a transferee in a contract for the transfer of permission to use a patent right are as follows:

- (1) The transferee shall use the patent right within the scope specified in the contract and shall not allow a third party to use the patent right;
- (2) The transferee shall pay for the use of the patent right according to the contract.

Article 38. A technology transfer contract that involves a patent should note the name of the invention, patent applicant, patentee, date of application, serial number of patent application, serial number of patent, as well as the duration of the patent right.

A contract that permits the exploitation of a patent is valid as long as the patent right remains valid. After the patent right has expired or has been annulled, the patentee shall not make contracts with other people that permit the exploitation of that patent.

Article 39. The primary obligations of the transferor in a nonpatented technology transfer contract are:

- (1) Providing technical documents and giving technical guidance as agreed upon in the contract;
- (2) Guaranteeing the practicability and reliability of the technology;
- (3) Undertaking the obligation to maintain confidentiality as agreed upon in the contract.

The primary obligations of the transferee in a nonpatented technology transfer contract are:

- (1) Using the technology within the scope as agreed upon in the contract;
- (2) Paying for the use of the technology as agreed upon in the contract;
- (3) Undertaking the obligation to maintain confidentiality as agreed upon in the contract.

Article 40. A transferor who breaks the contract shall bear the following responsibilities:

- (1) In case technology transfer was not made in accordance with the contract, the transferor should pay a fee for the breach of the contract or compensate for the losses incurred in addition to returning, in whole or part, the fees paid by the transferee for the use of the technology;
- (2) In case the exploitation of the patent or the use of nonpatented technology oversteps the scope agreed upon in the contract, and in case unilateral decision was made, in violation of the contract, permitting a third party to exploit that patent or use that nonpatented technology, the act of breaking the contract should be stopped, and a fee should be paid for the breach of the contract or the losses compensated for;
- (3) In case of violation of the agreement in the contract to undertake the obligation to maintain confidentiality, a fee should be paid for the breach of the contract or the losses compensated for;

Article 41. A transferee who breaks the contract shall bear the following responsibilities:

- (1) In case the transferee did not pay the fee for the use of the technology as agreed upon in the contract, that fee should be paid and another payment should be made, as agreed upon in the contract, for the breach of the contract. The transferee who refuses to do so should stop exploiting the patent or using the nonpatented technology, return the technical documents, and pay the fee for the breach of the contract or compensate for the losses incurred;
- (2) In case the exploitation of the patent or the use of nonpatented technology oversteps the scope agreed upon in the contract, and in case a unilateral decision was made without the transferor's consent, permitting a third party to exploit that patent or use that nonpatented technology, the act of breaking the contract should be stopped, and a fee should be paid for the breach of the contract or the losses compensated for;
- (3) In case of violation of the agreement in the contract to undertake the obligation to maintain confidentiality, a fee should be paid for the breach of the contract or the losses compensated for;

Article 42. In case the transferee, acting according to the agreements in the contract, exploits the patent and uses the nonpatented technology, thereby leading to the encroachment of other people's legal rights and interests, the transferor should be held responsible.

Article 43. In their technology transfer contract, the parties concerned may follow the principle of mutual benefit and agree on ways to share the fruits of improved technology subsequent to the exploitation of the patent or the use of the nonpatented technology. In case this is not agreed upon in the contract, neither party is entitled to share the other party's fruits of subsequent technological improvements.

## Chapter V Technical Consultation Contracts and Technical Service Contracts

Article 44. Technical consultation contracts refer to contracts a party concludes with another party to make feasibility verification, technical forecasts, special topic investigations, and analysis and evaluation reports in connection with specific technical projects.

Article 45. The primary obligations of the entrusting party in a technical consultation contract are:

- (1) Explaining the problems for consultation, and, as agreed upon in the contract, provide background materials for the technology as well as relevant technical documents and data;
- (2) Accepting the results of the work of the advising party and pay the remuneration as scheduled;

The primary obligations of the advising party in a technical consultation contract are:

- (1) Using his own technical knowledge to complete consultation reports or solve the entrusting party's questions as scheduled in accordance with the agreements in the contracts;
- (2) Presenting consultation reports that meet the requirements agreed upon in the contract.

Article 46. If the party seeking technical consultation fails to provide necessary data and information according to contract terms and thus adversely affects work progress and quality, the remuneration he has paid shall not be refunded, and the remuneration he owes shall be paid in full.

If the consultant party fails to produce a consultation report within the prescribed time or if the produced consultation report does not conform to contract terms, he shall receive a reduced amount of or no remuneration, pay a breach of contract fee, or compensate for the other party's losses.

Unless the contract provides otherwise, the party seeking technical consultation shall bear whatever losses he incurs from a decision made in accordance with the technical consultant's consultation report and suggestions if the report and suggestions conform to contract terms.

Article 47. Technical service contracts are contracts signed between two parties, one of which shall solve specific technical questions for the other with technical knowledge. They do not include the contracts for surveying, designing, engineering, and assembling jobs of construction projects, nor the contracts for processing jobs.

Article 48. The main obligations of the party seeking technical services are:

- (1) To provide the servicing party with the necessary working conditions and complete the supporting work according to contract terms; and
- (2) To pay remuneration within the prescribed time after receiving service from the servicing party.

The main obligations of the servicing party of a technical service contract are:

- (1) To provide the service within the prescribed time according to contract terms, solve technical questions and guarantee good working quality; and
- (2) To teach the knowledge for solving technical questions.

Article 49. The party seeking technical service shall pay remuneration in full even if he refuses to accept the service because of poor quality or has not received the desired service within the prescribed time, provided the poor quality or delay is a result of his breach of contract.

If the servicing party fails to provide the service according to contract terms, he shall receive no remuneration, pay a breach of contract fee, or compensate for the other party's losses.

Article 50. Unless the contract provides otherwise, new technical achievements made by the consultant party or the servicing party by using the technical data and working conditions provided by his customer in the course of fulfilling a technical consultation contract or a technical service contract shall belong to the consultant party or the servicing party. New technical achievements made by the recipient of consultation or service by using the consultation or service provided by the consultant party or the servicing party shall belong to the recipient, unless the contract provides otherwise.

#### Chapter VI Arbitration of Disputes and Lawsuits in Connection with a Technical Contract

Article 51. The concerned parties of a technical contract may settle their disputes through consultation or mediation. If they are unwilling to settle the disputes through consultation or mediation, or if the consultation or mediation fails to settle the disputes, they may apply for arbitration before state-designated arbitration authorities in accordance with the arbitration clauses contained in their contract, or in accordance with a written agreement on arbitration reached between them after the disputes arise.

If one of the parties fails to perform within the time limit the terms of the arbitral decision made by the arbitration authorities, the other party may apply for enforcement of the decision to the people's court.

If the contract does not contain any arbitration clauses and the contracting parties reach no written agreement on arbitration after disputes arise, they may take their case to the people's court.

Article 52. In case of disputes over a technical contract, a party shall take the case to court or apply for arbitration before the arbitration authorities within 1 year from the day that he knows or ought to know that his rights have been infringed upon.

#### Chapter VII Supplementary Provisions

Article 53. The Economic Contract Law is not applicable to any technical contracts that are concluded after this law comes into effect.

Article 54. The State Council departments in charge of science and technology may, in accordance with this law, formulate regulations on implementation, which shall go into effect after being submitted to and approved by the State Council.

Article 55. This law shall go into effect on 1 November 1987.

/9738

CSO: 4008/82

NEW CIVILIAN PRODUCTS REVITALIZE MILITARY PLANTS

Beijing ZHONGGUO JIXIE BAO in Chinese 2 Dec 86 p 1

[Article by Zhang Hongkai [1728 3163 0418]: "Outstanding Results as Military-Industrial Enterprises in Heilongjiang Province Develop Civilian Commodities"]

[Text] The principles maintained by military-industrial enterprises in Heilongjiang Province whereby "the military and civilian join together with a focus on the civilian; peace and war combine with a focus on peace; military industrial enterprises join with civilian enterprises, where lateral associations are paramount" have thereby taken the new road of propagating our strengths, developing civilian products, and improving the capacity for enterprise competition.

At present, the output value for civilian commodities produced by military-industrial enterprises throughout the provinces accounts for about 40 percent of the gross output value for these enterprises. These products have formed a series of civilian commodities such as vehicle, mining, and petroleum equipment and household appliances in 10 large categories with many varieties and classes.

The way in which military-industrial enterprises have developed civilian commodities have been:

They have made full use of advantages in technology and equipment to develop commodities where the techniques are quite similar and the technologies are interlinked. The Harbin Jiancheng Machinery Plant has fully utilized the technical power and equipment advantages in welding and punching to manufacture a series of products such as steel containers for liquid petroleum gas, liquified-gas tank cars, liquified-gas tubs, and cold storage equipment. The 15 kg liquid gas steel containers developed and manufactured by this plant were awarded a national silver medal, their supply has not kept up with the demand, and they are also sold abroad to various countries in Southeast Asia.

Civilian scientific research has been strengthened, and with the cooperation of higher institutions they have developed technology intensive products and new products in urgent demand in the marketplace. The Harbin Fenghua Machinery and Equipment Plant joined with higher institutions and institutes to jointly develop the scanning aiming device and the Huayu Model I isolated



welding robot for use in a paper quantitative moisture content measurement and control system, which filled a domestic void. The end milling cutter manufactured by this factory has been praised as a valuable cutting tool of the 1980's, and it has been sold in 28 provinces and cities.

They are seeking to survive through quality, they are creating top-quality name brands, and they are bold in competition. The "Songyue" brand washing machine manufactured by the Harbin Song Jiang Electric Machinery Plant was once considered a top-quality product by the Ministry of Ordnance Industries, but because of neglect of product quality it was largely ignored by customers. The factory has recognized that product quality is the safe conduct pass into the marketplace, and they have paid close attention to product quality. This year when they once again were commended by the Ministry they were also evaluated favorably by customers. The sports cartridge manufactured by the Mudanjiang Beifang Tool Plant has won a national gold medal and is generating foreign currency by sales abroad. Over the past few years, there have been 49 items from military-industrial enterprises that have been top-quality products at the ministry or higher level, among which 32 have been civilian products.

With key products in the lead, developing lateral associations has allowed enterprises to take off. With the "131" light motor vehicle as its key product, the Harbin Xingguang Machinery and Equipment Plant dispersed 70 percent of its components among 97 enterprises, which has promoted the development of local enterprises and has allowed both parties to the association to gain vitality and vigor.

12586

CSO: 4008/2048

## NATIONAL DEVELOPMENTS

### CHANGE IN MANAGEMENT STYLE URGED FOR MILITARY INSTITUTES

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 2, Apr 87  
pp 24-27

[Article by Ma Enhui [7456 1869 1920], Ministry of Astronautics, Institute No 42: "Some Thoughts on the Changes in Science Research Management at Light-Industry Institutes"]

[Text] To adapt to the restructuring of the science and technology system in the national defense industrial system, research management at light-industry institutes must implement three changes: a change from the management of research on exclusively military goods to management of research operations and development in the integration of the military and civilian sectors; a change from a closed mode of management to an open style; and a change from process management to goal management. As far as management directions are concerned, implementation of the three changes should preserve a focus on research, should proceed from the development of one's own technical strongpoints, should enhance the development of new products, should adapt to expanded capacities for intermediate testing, and should energetically develop the integration of institutes with factories; regarding management modes, we should unleash "invigoration" in the three areas of systems, organizations, and research topics; and regarding management methods, we should replace process management with goal management, focusing on paying close attention to the selection of topics, the evaluation and approval of achievements, and the dissemination of applications.

The "Resolution of the CPC Central Committee Regarding the Restructuring of the Science and Technology System" points out the directions for the restructuring of the science and technology system within the national defense industrial system. To fit the restructuring of the science and technology system into the national defense industrial system, scientific research management efforts at the military industrial institutes (hereafter, military institutes) must implement three changes:

I. Change from Management of Research on Exclusively Military Goods to Management of Research Operations and Development in the Integration of the Military and Civilian Sectors

Scientific research management in China's military institutes has for years followed Soviet management patterns, which deal exclusively with scientific research on military goods. The military institutes have dealt exclusively with topics in the research on military goods, the tasking for which has been uniformly deployed by the state; expenses are uniformly provided by the state; materials are uniformly allocated by the state; personnel are uniformly deployed by the state.... This thoroughly "uniform" scientific research system only allows research management at the military institutes to be the management of research on military goods, that is, to be in accordance with the demands of the tasks, rates of progress, and quotas set by the state or by higher echelons, and areas of management concerned with planning, technology, finances, and labor wages. As long as planning is in accordance with the rate of progress, technology (performance) is according to norms and expenses do not exceed allocations, the mission of the institute is fulfilled. Management of this sort is quite obviously not suited to the demands of the four modernizations.

The "Resolution" makes it clear that "the national defense scientific research organizations should establish new systems for the integration of the military and civilian sectors, and at the same time as they ensure completion of national defense tasks, they should cater to economic construction, should quicken the shifting of military technological achievements to civilian use, and should energetically initiate developmental research for civilian goods." The "Resolution" has two provisions regarding the central substance of the restructuring of research management in the military institutes: (1) Research expenses will gradually shift from allocation to economic self-sufficiency; (2) scientific research must cater both to the building of national defense and also to economic construction, and it must serve construction in those areas and also the four modernizations. Because of this, the substance of scientific management efforts at the military institutes must change from that which conducts research exclusively on military goods to the management of scientific research operations and development in the integration of the military and civilian sectors, that is, the so-called "turnaround model."

At present, there are generally three ways of speaking of the "turnaround model" for the military institutes: the scientific research operations model, the scientific research production operations model, and the scientific research operations development model. Although that last phrase is not common, this writer feels that this wording is more in keeping with the direction of restructuring for military institute management. This clearly reflects in full the entire substance of management for the military institutes. That is, on the basis of improving existing scientific research management, we increase the content of "operations" and "development." By "operations" we mean primarily technology operations, including the transfer of rights to technology, technology contracts, consulting work in technology, technical services, technical training, and technology shareholding. By "development" is meant for the most part the development of new products, including research on and the test production of new products and test marketing.

The phrase "scientific research operations model" is incomplete, for it ignores the important subject and link represented by new product development. A military institute that does only scientific research and technology

operations is hard put to attain economic self-sufficiency. At the same time, in regard to this aim of science and technology catering to economic construction, only by getting involved with new products can there be a true connection with economic construction. For research achievements, too, it is only in the process of new-product development, intermediate testing, and test marketing that complete technological materials can be provided for their commercial production.

The phrase "scientific research production operations model" is not correct. This writer feels that institutes are not suited to production. Although "scientific research" and "production" both belong within the scope of production forces and there is an inherent relation, there are great differences in terms of the directional thinking in their work, their substance, object of service, management methods, and processes. When institutes undertake commodity production, they must weaken their research capabilities, which affects the development of new products and new technologies and can even change the directions of the institutes. Also, the institutes lack a set of management methods and marketing channels with which to undertake commodity production, and this is not easy to do at the beginning. If an organization is going to be involved with commodity production, it must also have commodity operations, and if we are to change the technology operations of the institutes into commodity operations, this method is counter to the presently advocated research-production associations and the slogans concerning the development of bilateral economic relations.

Therefore, the restructuring of research management has two points worth noting:

First, we must maintain the direction toward "research," which proceeds from the development of a group's own technological strongpoints. When "research" is the focus, this means that the focus is on scientific and technological research. This research must cater both to the building of our national defense and also to economic construction. If the military institutes are to be economically self-sufficient, in addition to accomplishing their military industrial tasks, they must also uncover financial resources, which are primarily dependent upon a greater output of achievements. As much as possible, they can take on more research tasks as commissioned by governments and enterprises, they can resolve key technological problems in national construction and enterprises production, and they can obtain corresponding gains through the compensated use of achievements. At the same time, military institutes must also be willing to invest in areas they would select themselves as having a decisive impact on the growth of a particular specialty in order to maintain their competitive capacity from the technological standpoint. Conversely, if they are exclusively seeking economic gains and are making a fresh start, taking up production in a big way, and "using production to nurture scientific research," they will diverge from the direction of restructuring the management of research in the military institutes.

Second, we must enhance the development of new products, must appropriately expand capacity for intermediate testing, and must develop the integration of

institutes and factories. Because contemporary technology markets have not been completely formed, the achievements of new-technology and new-product development research must materialize before they can enter the markets. In order to enhance the process of materialization for achievements, an appropriate expansion of intermediate-testing capacity will be necessary, and this happens to be the weak link in military institutes, as many military institutes lack a capacity for intermediate testing. One way to resolve this contradiction would be to expand intermediate-testing capacities with state funds or with funds developed through the units themselves. Intermediate-testing capacities should be appropriate to the research capacities of all institutes. When intermediate-testing capacities are excessive, the tasks are never satisfied; when too little, the tasks cannot be done, and both extremes are to be avoided. Another way would be to adopt and develop the integration of institutes with factories. Integration of institutes with factories has joint operations as its goal and joint economic profits as its bond and relies upon the specific strengths of each. This would also benefit the institutes and factories by overcoming their own weak links and enhancing their competitive capacities.

## II. Changing from Closed Management to Open Management

Management methods for exclusive research on military goods are fundamentally closed. Closed management means that the management functions of an institute are confined within the institute, and are characterized by a management that is internally directed; outside the institute management is confined to vertical channels of top to bottom affiliations and relations and to a few cooperating units. A closed form of management leads to problems such as unitary military institute tasking, organizational stagnation, following the beaten path, sticking to conventions, overstocking of skilled personnel, and excessive internal consumption. Based on the original internal management and vertical channels, to the functions of the management of military institutes after the "turnaround model" will be added those of lateral association. There would be a taking on of "operations" and "development" responsibilities with external interests, both for military goods and for civilian goods. Sources for research topics would be broader, there would be wide scope for achievement applications, they would cater to society, and they would cater to economic construction. The essence of changing from a closed form to an open one is "invigoration" of the research management of the military institutes while achieving that invigoration without anarchy. Therefore, in the areas of management procedures, structures, organizations, and management methods, there must be a corresponding restructuring.

(1) "Invigoration" of the system. There will be compensated contract systems for dealings outside the institute, and internally the topic responsibility systems are a fundamental measure of the management system for "invigorating" the military institutes. The compensated contract system is a new kind of scientific research operations management system, and it definitely does not simply change prescriptive tasks into contract projects, nor does it just generally change the modes of allocation. Rather it requires the military institutes to change gradually from their former expense provision system to one of economic self-sufficiency and to break up the "common pot" in the areas

of economic resources and usage, all of which will enable the technology development of the military institutes to gain the necessary power, pressure, and vigor. The research topic contract system is currently controversial, the reasons being the powerfully exploratory nature of research work, the many random factors, and the difficulties in assessment, all of which are the special rules of research, but these rules can be known and mastered. What is more, the military institutes are generally focussed on applications research and development research, the characteristics of which are clear research objectives, short duration, a high rate of success, and a close relation to production, from all of which may be determined relative indices for assessment. This has provided feasible conditions for project contract systems. Naturally, in practice this can be done in stages and by categories, and the particular methods can be gradually perfected through exploration.

(2) "Invigoration" by structures. Structures are an organizational measure for "invigorating" the military institutes. To carry out the invigoration, we must enhance the management function, and currently we should be emphasizing the replenishment of operations service structures; we should add more development structures for civilian goods; we should enhance economic accounting; and we should strengthen technology reporting and work in the forecasting of technology market data. We must choose people to enrich management efforts who have good management natures, are highly efficient, are dedicated workers, and have a sense of responsibility. This will clear channels of information for the military institutes, management will be flexible, efficient, and capable, and this will resolve problems where at present there are too many levels of management, structures are overstaffed, responsibilities are shifted and there are disputes, and capabilities and efficiency are low.

(3) "Invigoration" by research topic organizations. Research topic organizations are the liveliest basic-level organizations, and invigorating the research topic organizations is fundamental to invigorating the military institutes. We should organize the research topic groups into a provisional technology contract unit that combines responsibility, authority, profits, personnel, finances, and materials. Responsible departments for the institutes directly sign provision contracts with research topic groups. The topic group leader will be the chief engineer, and personnel will come into the group freely. When a project is finished, examination and verification before acceptance will be organized by the responsible department. After completion of a contract, in principle this research topic groups will be disbanded. Upon taking on new topics, it can be reconstituted. The advantages of operating in this way are that the topic goals are definite and the responsibilities are clear; this encourages scientists and technicians to work hard and shortens the period of development; it is good for the circulation of personnel within the institute, so people do their best; people who hit it off perfectly work together, and they are all agreed on their aims; and this is a great impetus for those who have not fared well in ordinary times, who have difficulty joining with others, and who are less able, and this will hasten changes in them.



### III. Change from Process Management to Goal Management

The closed mode of management causes the research management methods of the military institutes to be largely process management centered on scientific research planning. It emphasizes the taking up of research topics, arrangement of the rate of progress in planning, execution of check-ups on planning, coordination, and comprehensive balancing, and technology and quality management in the process through which planning is implemented, as well as the evaluation of achievements. Without question, these management methods are very important for completing instruction tasks, for hastening the rate of progress for scientific research, and for reducing the period of time for development.

With the advent of the "turnaround model" in the restructuring of the science and technology system and for the military institutes, as well as the implementation of a compensated contract system and research topic responsibility system, research topic responsibility groups have clear goals for the topic tasks they take on, for the requirements of the rate of progress for planning, and for the technical indices (performance) attained. In addition, responsibilities are clear, and whether goals are realized or not will be directly related to the personal benefits to members of that group. Therefore, the problems that existed in the past with elastic planning, shirking of responsibility, extravagance and waste, and low ability and effectiveness will gradually diminish and even disappear. In this way, as far as management methods are concerned, it will no longer be appropriate to focus on process management; rather it will be to make the realization of the final achievements of the research activity and goal management, aiming at acceptance of those final achievements, the focus of research management.

Goal management is at the center of motivating the enthusiasm of people and is a kind of management method that is careful about work efficiency and emphasizes achievements. More particularly, by predicting the outcome of achievements from work, each person in the research group will have as his own goal the work achievement that should be realized within a definite period of time, and work will consciously proceed with this goal in mind. In realizing the goal, we should emphasize the methods of self-control and self-management. The function of leaders and of research managers is to formulate goals through negotiations through upper and lower levels and to investigate the final achievement realized from the goal through strict checking, as well as to coordinate the research group in making its achievements materialize as quickly as possible.

After process management has been transformed into goal management, the focus of research management should take the following two links to heart:

1. Pay close attention to the selection of topics. Research topics for military goods come for the most part from higher echelons, and aside from seeking out even more research projects of that nature that are suited to the particular institute, there is not much room to be flexible and expedient. The selection of topics for developing civilian goods should be under the premise of market demand, should have economic results as their goal, and

should have as their primary conditions the fulfillment of the technological advantages of the particular unit. Topics should be selected that are concerned with key technologies in urgent need of resolution in national economic construction, as should topics that could have an important effect on the long-term development of the national economy. Only by correct selection of a topic can we formulate goals where the outcome is quicker and the success rate is high.

2. Pay close attention to achievement appraisal and the dissemination of applications. In implementing goal management, the examination and appraisal of achievements are extremely important. After topics have been contracted, the responsible departments must accomplish the goals provided for in the contract while ensuring quality and quantity when required and in keeping with the needs of the research group. Regarding particular questions as the research topic progresses, there are those that may be ignored, those that cannot be managed, and those that are managed poorly. This then requires strict efforts at achievement appraisal and the strengthening of appraisal mechanisms and measures. The central concern of appraisal is the examination of conditions regarding the execution and completion of the contract, and this is the specific examination for the goals.

After completion of the appraisal, the mission of the research topic contracting group is considered to be basically over. But as far as the research management department is concerned, its mission is not yet complete, and it has the function of further disseminating and applying the achievement. Efforts at disseminating achievements should primarily depend upon the research management departments, with help from research personnel. This work is the weak link in research management at the military institutes and should be respected and enhanced. Military institutes should not be satisfied that their own achievements are being applied in a particular project or at a particular enterprise, but instead they should have as their goal the broad application of their achievements within the scope of application.

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## NATIONAL DEVELOPMENTS

### NEW JOINTLY FUNDED S&T OPERATIONS OPEN IN SHANGHAI

Beijing GUANGMING RIBAO in Chinese 19 Dec 86 p 1

[Report by Xie Jun [6200 6511]: "A Group of Middle and High Level Scientists and Technicians in Shanghai Are Running a High Technology Enterprise in Science City"]

[Text] The first Chinese-foreign joint investment high technology enterprise in Shanghai with a core of middle and high level scientists and technicians--the National Jiading Optoelectronics Company, Ltd., formally began operations on 17 December in the Jiading Science City.

The National Jiading Optoelectronics Company is a new type of enterprise jointly funded and run by the three parties that are the China International Trust Company, the Hong Kong Dacheng Company, Ltd., and the Shanghai Jiading Agricultural, Industrial, and Commercial Associated Enterprises, Inc. Twelve high level specialists and engineers formerly with units of the Shanghai Institute of Optomechanics of the Chinese Academy of Sciences and the Shanghai College of Science and Technology are the nucleus through which this enterprise carries on management, science research, and trade. The well-known scientist, Deng Ximing [6772 6932 6900], is their chief advisor. This company focuses on the development and production of various new products and equipment, such as laser precision machinery, electronic instruments, optics materials, and things related to optoelectronics technologies. They import and absorb advanced optoelectronic technology and equipment from abroad and provide new optoelectronic technologies and products for the domestic market.

Professor Deng Ximing said at the opening ceremonies: "It is our plan that scientists and technicians will create an environment for mutual competition concerning research, products, and skilled personnel, and that with new concepts, new knowledge, and a new spirit we can allow scientists and technicians to display their skills in the entrepreneurial arena."

12586  
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BEIJING SETS UP COMPUTER SOFTWARE JOINT VENTURE

HK230452 Beijing CHINA DAILY (BUSINESS WEEKLY supplement) in English 22 Jun 87  
p 1

[By staff reporter Wang Yanping]

[Text] The Beijing Stone Group Corporation (BSGC), specializing in the development of computer software, has pressed the fast-forward button to enter the world market by launching a joint venture with a Japanese company.

The high technology joint venture to produce MS series Chinese-English typewriters and its accessories, was set up in the northern suburb of Beijing at the end of last month with a total investment of 4 million, of which the BSGC put in 75 percent and Mitsui Company holds the remainder.

Of the Chinese share, 30 percent is in the form of technology for the advanced Chinese-English MS typewriter series.

"This is the first time in China that a Chinese company has put its technology in as share capital to set up a joint venture with a foreign business," said Li Yuzhuo, director of the production department of Beijing Office Equipment Technology Company--the name of the new venture.

It will have an annual production capacity of 20,000 to 100,000 MS series typewriters including the Chinese-English typewriter and printers. The venture plans to produce 60 percent of its parts in two or three years in China. Now, they are mainly imported from Japan.

The BSGC will act as agent to sell 70 percent of the products on the domestic market and the Japanese company will be in charge of the other 30 percent abroad. In the future the venture will set up a marketing network overseas to get a hold on the world market, said Li.

The MS series Chinese-English typewriter to be produced by the joint venture has been considered by a leading British company dealing in office automation as the best in the world in terms of price and function.

In the world there are about 10 types of Chinese-English typewriters. The MS 2400, developed by BSGC in cooperation with Mitsui a year ago, has been enjoying good sales, with 7,500 sets sold in a year, according to BSGC.

"There is a great potential market both at home and abroad, if we adopt a suitable policy on marketing, it is possible for the venture to sell 40,000 to 50,000 sets yearly and the export volume is expected to account for 30 percent," said Cao Wuqi, director of BSGC's General Manager Office.

The establishment of the venture means that the BSGC can manufacture products at home. In the past the BSGC provided the technology and was in charge of sales on the domestic market and the Japanese company produced the machine.

Cao said: "We are considering setting up a computer research institute in Japan in order to follow the latest technology and market trends in the world."

Cao explained the advantages of setting up the venture. "First we can save foreign currency, over which we always have trouble, by importing parts rather than the complete sets and thus we can undercut competitors."

"Secondly, we have more freedom to organize production in light of the domestic market because we have flexibility when we import parts. And this is advantageous to the gradual localization of production since we can use domestic-made components as substitutes."

Cao said the joint venture resulted from cooperation between BSGC and Mitsui. The first cooperation was in 1984 when the Beijing Stone Corporation, the predecessor of the BSGC, was initiated by several engineers headed by Wan Runnan who quit his job as a director at the Chinese Academy of Sciences.

In 1984, there was an intense popular interest in micro-computers. Many units imported IBM-PC computers, but many microcomputers lay idle since the inputting and outputting of Chinese words was not solved. The Beijing Stone Corporation imported a M2024 printer from Mitsui and made it compatible to IBM-PC computers in a short time. The development proved a success, saving the country 9 million of imports.

The Beijing Stone Corporation's efficiency surprised the Japanese company, which showed its willingness to cooperate in developing a Chinese-English typewriter in 1985.

A year later, MS 2400 Chinese-English typewriter, an ideal system of Chinese word processing, was brought forth and became the corporation's main earner.

In May the BSGC and Mitsui developed another kind of Chinese-English typewriter the MS2401, with the former providing the software design and the latter the hardware.

"With the establishment of the joint venture more new models will be developed," said Cao. "We are concentrating on processing the original form of the simplified Chinese words and the prototype is expected to be put on market late this year."

In three years the BSGC, a collectively-owned corporation has grown massively. It has eight branch companies nationwide and more than 100 sales offices.

Plans are afoot to set up another six branch companies in Hong Kong, Tianjin, Chengdu, Shenyang, Fuzhou, and Xian.

The BSGC has a staff of 300, with 3 million yuan in fixed assets and 10 million yuan in capital. In three years, it has added 10 million yuan to the State's revenue. This year the corporation's revenue. This year the corporation's sales volume is expected to reach 200 million yuan.

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CSO: 4010/1033

BROADER SOURCING OF TECHNOLOGICAL IMPORTS ADVOCATED

Beijing GUOJI SHANGBAO in Chinese 4 Apr 87 p 3

[Article by Li Xiao [2621 2556]: "A Preliminary Discussion of the Diversification of the Sources of Technological Imports: The S & T Development of Every Nation Is Inseparable from Technological Imports, and Sourcing Diversification Is an Important Element in Importing Technology; This Conclusion Is Derived from Successful Experience Obtained in This Work"]

[Text] Diversification of technological import sourcing refers to the practice by which countries fully exploit their own advantages (such as in markets, resources, labor and the like) and the developments and changes in the international economy to import technology from different countries and regions through a variety of means and channels so as to achieve a wide range of sourcing, to avoid the political and economic restrictions imposed by exporting countries and to accelerate domestic S & T development. The history of world S & T development and the economic development of every nation is inseparable from technological imports and that sourcing diversification is an important element in importing technology. These conclusions are derived from the successes many countries have attained in importing technology, of which the Soviet experience is particularly useful for China.

The imperialist nations' hostility towards and efforts to encircle and besiege the Soviet Union following the October Revolution and the practice adopted after World War II by these countries, led by the United States, of using credit, technology and equipment supply as a lever with which to apply political and economic pressure on the Soviet Union made it impossible for the latter country to rely on one or two imperialist nations to provide her with capital and advanced equipment and prompted her to diversify her import sources and channels and to exploit political and economic contradictions among imperialist nations, which policies enabled her successfully to import much advanced technology and to strengthen herself. For example, the Soviet Union took advantage of the world economic crisis of 1973-5, during which many Western nations frantically scrambled and competed for markets, to win easy separate purchases of much modern technology and equipment from the United States, France, Japan and other such nations. The construction of the famous and huge Aosikeer integrated steel mill greatly stimulated the growth of the Soviet steel industry and helped make

Soviet steel output in 1980 more than 25 percent greater than the level in 1970.

Since the beginning of the 1980s, China has imported much technology and equipment from Japan, the United States, Western Europe and many other countries and regions. Nevertheless, "monolithic" sourcing still persists with respect to certain regions and to certain specific products. In these cases, we have failed to take advantage of the buyer's market we enjoy, to "guard our gates" and to obtain advanced technology from a wide range of sources and thus have subjected ourselves to one restriction and obstruction after another in our efforts to import technology from Western nations and have failed to improve our technology by selecting the best products from a wide variety of nations. For example, in initiating an economic and technological development zone in 1984, one city made Japan its main source of capital and technology and thus unwittingly excluded European and American nations, and yet investment the city has received from these nations and Hong Kong has since markedly outstripped that from Japan.

In point of fact, we should diversify our sources of imported technology and make this approach an important strategic policy in our technological import work.

First, in the short run, the low economic growth rates of the West favor our efforts to diversify our technological imports. Western economies continue to stagnate, and markets in most developing nations, which are affected by Western economies, cannot easily be expanded due to developing nations' heavy debt burdens and to other factors. This impedes the capitalist nations' efforts to build markets in each other's countries and thus increase importance of markets in socialist nations, which are economically stable. China's open-door policy undoubtedly provides Western nations with an especially good opportunity, and these nations, for their own vital economic interests, are bound to initiate intense competition and rivalry over our market. Under these conditions, for key projects and products, we should take bids from all sides, select the best offer and make the best deal. In this way we can reduce expenditure of foreign exchange and obtain as much good technology as possible.

Second, since the 1970s economic clashes among Western nations have grown increasingly intense; spread from steel, automobile and textile trade to high tech; and ignited widespread protectionist fever. Consequently, with the development of the international division of labor and the internationalization of production, Western nations have increasingly come to view foreign investment as the simplest way of resolving economic conflict. And this view objectively is conducive to the diversification of China's imports of advanced Western technology and equipment.

Third, China's economic and technological cooperation and trade with the Soviet Union and Eastern Europe has recovered and grown considerably. While striving to import advanced technology from the West, we should also obtain suitable technology and equipment from the Soviet Union and Eastern Europe so as to avoid Western restrictions, combine Eastern and Western technology, diversify imports and thus develop our economy.

SUGGESTIONS FOR INTEGRATING S&T WITH PRODUCTION

Tianjin JISHU SHICHANG BAO in Chinese 9 Dec 86 p 1, 4

[Article by Sun Shuyi [1327 2885 5030]: "Actively Promote the Unification of Science and Technology with Production"]

[Text] The integration of science and technology with production is a requirement for the development of a socialist commodity economy. It is an important matter for the restructuring of the urban system, will hasten economic construction in this country, will develop the causes of science and technology, and will improve the strategic questions regarding the quality of the nation. To this end, we have undertaken investigative research on the problem of how to further promote the integration of science and technology with production, our views being as follows.

I.

Since the promulgation by the State Council of the "Resolution Regarding Some Problems in the Further Promotion of Economic Integration," research organizations and production enterprises have actively developed associations of various types.

-- Broad opening up of the technology markets and opening channels by which scientific and technical achievements flow into production;

-- factory and institution associations have developed integrated cooperation in problem solving, from which they have obtained outstanding economic results;

-- scientists and technicians are working concurrently in small to medium enterprises and scientists and technicians are moving into production enterprises, which has not only strengthened the technical development capacity of enterprises, but has benefited the fostering of a composite type of skilled personnel who understand technology, understand economics, and understand the law;

-- industrial technology development foundations have been constituted from local investment and bank loans to take risks, to subsidize items of high economic results or social results, and are beneficial for investment decision making in accordance with a scientific program and economic results;

-- research institutes have become technology development centers for small to medium enterprises, which has strengthened the competitive capacity and product levels for small to medium enterprises;

-- research institutes and enterprises have jointly founded intermediate test lines, which have quickened the shift of science research achievements into production;

-- the associations of research units and production units that transcend regions and sectors have struck a blow against the old system that created barriers.

The forms of these associations have played an active role in promoting the integration of science and technology with production. However, these forms have been constituted on the basis of not affecting existing organizational structures in enterprises and institutes. Consequently, there is no great possibility for fundamental resolution of the "two skins" that are science and technology on the one hand and production on the other, and the mechanisms of motion that are individual systems, independent development, and self-perfection. Recently, it has happened that at test sites for enterprise blocs, independent research units have joined enterprise blocs or have merged with large enterprises to form new production, development, and operations type enterprises that are "unifications" of science and technology with production. These have exhibited superiority in solving the problem of the "two skins" that are science and technology on the one hand and production on the other. The appearance of these enterprises that "unify" science and technology with production is an intensification of the restructuring of the urban and economic systems, and they are also a new stage in the development of lateral economic associations. They have provided an extremely beneficial model that at the system level resolves the integration of science and technology with production.

Reform has stimulated the integration of science and technology with production. But in the current situation where the new and old systems are confronting each other, the integration of science and technology with production is still under the pressure and limitations of the old system and old concepts. Viewed overall, the current problem where science and technology are seriously separate from one another has not been fundamentally resolved, and the two still continue to strengthen and develop independently along two tracks.



## II.

There are many varied manifestations of the serious rift between science and technology and production:

Our existing scientific and technical power in this country has not been fully utilized. According to statistics, of the total number of scientific and technical achievements used by medium to large enterprises in this country, 63 percent have been developed by themselves, while only 6.4 percent have come from science research organizations independent from and outside the enterprise.

The rate of transfer of rights to achievements has been low. In 1983, before the restructuring of this system, the rate of sales of the technical achievements of research organizations throughout the country has averaged only 27 percent. In the early period of the restructuring, because of the compensated transfer of rights to achievements that had accumulated over the years, the rate of transfer was raised to 41 percent. For reasons having to do with the restructuring, in recent years this transfer rate has gone back into decline.

The period for the transfer of rights to achievements is too long. An item of development of any particular level has a period of transfer of nearly 10 years.

The technical levels of enterprises is low, equipment is outmoded, and the technologies and equipment of medium to large enterprises is of a lower proportion than the international level at the middle and end of the 1970's; there is high consumption of raw materials, and the energy consumption to generate products worth \$10,000 is four times that of the United States, and 5.6 times that of Japan; the rate of product renewal is low, and in 1985 the new product output value for medium to large enterprises throughout the country was only 7 percent of gross output value.

There is unnecessary duplicate importation and a separation of importation from absorption and assimilation. Abroad, the ratio between general import expenses and expenses for absorption and assimilation is from 1:4 to 1:7, while in this country it is 4:1 or 5:1.

Production enterprises have not respected domestic science and technology and they have not respected the absorption and assimilation of imported technology, the necessary consequences of which are that there has been insufficient respect for scientists and technicians within the enterprise. When you add to that factors having to do with policies, a considerable portion of scientists and technicians are unwilling to remain in or transfer to the enterprises. According to statistics, there were 4,269 scientists and technicians at the level of engineer or above who transferred to institutes, while only 2,747 went from the institutes to enterprises.

There are many aspects to the reasons these problems have appeared.

-- Systems that have created barriers cause enterprises and institutes to still be extensions and adjuncts to government administrative and management departments, and they have no autonomy.

-- Reform policies have not been complementary.

-- Existing science research and production management systems are still self-centered, forming systems that are complete in themselves. Although progress has been made by each department regarding problems with the integration of science and technology with production, particular policies in the restructuring are largely formulated within the confines of the old management system, and the restructuring itself has been stamped with the brand of barrier creation.

-- People who violate economic laws and the laws of science and technology efforts are administrative obstructions, and have constituted a loss for this bilateral integration.

-- Intermediary links and the weakness of middlemen structures have led to the divorce of science and technology from production.

### III.

The integration of science and technology with production is a complex, meticulous social system process that involves a broad area and has strong policies. Resolving the "two skins" that are science and technology and production in this country and promoting the "unification" of science and technology with production had become a component and important aspect to the restructuring of contemporary economic, science and technology, education, and political systems. Speaking from the point of view of current efforts, we should work in the following two areas: one is to revise and eliminate outmoded policies obstructing the integration of science and technology with production to formulate complementary policies to promote the integration of science and technology with production, which will allow each policy to be largely rational, mutually coordinated, and completely feasible. Second, is to adjust and reorganize the existing structures that are divorced between science and technology on the one hand and production on the other, to gradually form new types of enterprises that combine production, development, and operations, and to realize a rationalization of organizational structures.

To promote the integration of science and technology with production in actual work, we propose the following ideas and suggestions for restructuring.

First, to strengthen the capacity of medium to large enterprises to make use of new technologies, as well as their capacities for self-transformation, we must resolve seven problems: 1) to earnestly organize and investigate implementation of policies and measures relevant to the promotion of enterprise technical advancement; 2) the state must enhance overall guidance, and for the sake of enterprises should create buyer's markets beneficial to competition; 3) improve the level of profit retention by enterprises, and in a

discriminating way, improve the rate of depreciation on fixed assets of a production enterprise; 4) give preference to aspects such as deduction before taxes of the investment by enterprises in the aspects of research development, to a share in costs, to repayment of loans before taxes, and to reduction or exemption from taxes for new products; 5) complete exemption from regulatory taxation to encourage enterprises to invest more of their retained profits into research and development; 6) for products that have high R&D expenses, open up marketplace selling prices to allow an equilibrium between domestic selling prices and international prices; and 7) for items that have good social results but for which enterprises are temporarily unable to gain a profit, for items the promotion of which development are in accordance with the direction of enterprise policies, and for basic complementary parts in large quantities and broad scale, the state should adopt measures to subsidize technology advances for enterprises.

Second, support the development of lateral associations between independent R&D organizations and enterprises, promote the "unification" of science and technology with production, and pay close attention to test sites for "unified" enterprises and enterprise blocs.

-- Formulate beneficial policies to guide and encourage independent institutes to participate in enterprise blocs and to merge with medium to large enterprises.

-- The state can provide preferences in areas of taxation and loans, can support technology intensive enterprises comprised mainly of science research organizations and which absorb products that are "high-level, precision, and top-notch" and manufactured by collaborating enterprises.

-- Correctly handle current and future relations. For research organizations that are already part of enterprise blocs, their primary mission is to serve the development of new products by a particular bloc based on strengthening enterprise reserves. At the same time, we want to do a good job with preparations for technology and skilled personnel for the further development of our economy in the early part of the 21st century to meet the challenge of the new technology revolution.

-- In the early stages of adjusting directional tasking and affiliations for military-industrial research units, support taking the lead in the forming of research-production unified enterprise blocs from military-industry and civilian enterprises and institutes, and avoid the old path of striking first then falling behind.

-- Continue with reforms of the science research allocation system, and encourage institutes to assume responsibility for development projects for enterprises, provide technical service to enterprises, then go on to participate in enterprise blocs and medium to large enterprises.

Third, make full use of the open-door conditions to expand technology imports in a planned way, to hasten the technological transformation of the national economy, enhance absorption, assimilation, and innovation, improve the starting points for scientific and technical efforts in this country, and

speed up the nationalization of imported equipment. This will break through the limits of created barriers and give rein to the advantages of research and design organizations and higher institutions; there should be a gradually shared responsibility for imported technology by research, design, and production units, and the emphasis should be on science research and design organizations; we should closely integrate the assimilation and absorption of imported technology with domestic scientific and technical problem solving and with R&D projects, and should avoid rifts between these things, which lead to waste of personnel, finances, and materials.

Fourth, strengthen intermediary links between production and research, and set up and clear channels by which technical achievements flow into production. Regarding the sites for intermediate testing, intermediary organizations, and intermediary advising organizations, the state should provide support and promotion; in arrangement for fixed assets investments and capital construction, we should give preference to considering the establishment of intermediate test bases; initiate the formation of technology development foundations at different levels to make full use of the advantages of integrating intellect and funding; through the reduction of or exemption from taxation, provide preferential loans and subsidies, open up sources of information, support and encourage the establishment of various specialized and comprehensive information organizations.

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PRIVATE ENTERPRISE ACHIEVEMENTS NOTED

Beijing RENMIN RIBAO in Chinese 9 Jan 87 p 3

[Article by Zhang Minqiu [1728 2404 3061]: "Civilian-Run Science Research Organizations in Shanghai Show Vitality"]

[Text] During the restructuring of the economic system and the science and technology system, a group of collective and individual science research organizations has sprung up in Shanghai. The majority of these organizations have been initiated by scientists and technicians who have quit their jobs or some who are retired. Small in scale, vigorous, strongly adaptable, and practical achievements are the characteristics of these research organizations. Over more than a year, they have exhibited much vitality.

Although the Liming Electromechanical Engineering Company is a small collective company with only five specialist scientists and technicians, there is a group of moonlighting personnel that gives it abundant strength. The company was founded just over a year ago, but has developed nine new technologies and new products. The Juling workshop of the Jinshan Petrification Main Plant is the "key" shop for the production of Dacron, but because the control equipment for the assembly line was outmoded, it would often break down. They estimated that for each hour it was shut down, they suffered losses of about 80,000 yuan. Control system transformation is an item of technology that is highly difficult and risky. In just 1 month, the Liming Company did the amount of work an ordinary unit would have needed 4 months for, and developed two sample machines. The customer was delighted and immediately signed a contract for the technological transformation of the six production lines in the workshop, for a total value of nearly 320,000 yuan.

The collective science research organization Shanghai Forefront Information and Technology Development Company, Ltd. is primarily concerned with technology development efforts in the areas of computer software, communications technology, and automation instrumentation and meters. In the 2 years of its existence, it has developed 24 items, among which two have been included among major science research projects of the municipal science and technology commission. The mainframe Chinese-language office automation system it developed in 1986 has been successfully used by more than 200 units in the offices of the central authorities, the Shanghai municipal government, and Shanghai's Baogang. After representatives of the United Nations Food and

Agriculture Organization had visited Shanghai, they indicated they would like to use this system to handle Chinese word processing.

The scale of independent research organizations in Shanghai is quite small, but here there is a group of scientists and technicians that is truly talented and accomplished and that has completed many projects in urgent need of resolution in production and research. Engineer Zhou Qingyun [0719 1987 0061], who after quitting his job founded the Bianyou Plastics Laboratory, has developed a new kind of polyurethane, and the polyurethane rice huller roller made by him replaces the original black rubber roller, and is being used in more than 60 grain processing plants in Shanghai, Jiangsu, and Zhejiang. Processed grain volumes are three times higher and more, there are fewer broken grains, the rate of polish is higher, but more importantly it solves the problem of pollution in husked rice processing. This new material has been broadly applied, and it may be used in many aspects of petroleum, chemical industries, and textiles. Wang Xiangzhong [3769 4382 1813], founder of the Eastern Biochemical Products Laboratory in the Huangfu District, developed a stomach cancer reagent from the urine of pregnant women in only three months. This kind of reagent can only be manufactured in a few developed countries, so now we need no longer spend foreign exchange to bring it in from abroad.

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## NATIONAL DEVELOPMENTS

### MORE WORK URGED ON REVERSE ENGINEERING EFFORTS

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 2, Apr 87  
pp 14-18, 45

[Article by Yang Qingquan [2799 1987 0356], Liaoning Province Academy of Mechanics: "Strongly Develop Lateral Associations To Quicken Absorption and Assimilation of Imported Technology"]

[Excerpts] This paper uses actual examples and data to explain the successes China has obtained in the areas of imported technology during the period of the "Sixth 5-Year Plan," as well as errors and mistakes that still exist. Citing the example whereby after the war Japan took the path of importing-absorbing-innovating-exporting, we review our actual experiences over the past few years to clarify the importance and urgency of absorbing and assimilating imported technologies. This paper describes the process whereby the Liaoning Province Academy of Mechanics is vigorously developing bilateral associations in the four areas of research, enterprises, importing units, and customers. This is to hasten the absorption and assimilation of imported technology and also to develop the conditions that will permit the national standardization of equipment. It has been proven that this not only is feasible but also has great vitality. Finally, this paper presents six constructive opinions for promoting the healthier growth of absorption and assimilation efforts for imported technology.

#### I. Basic Situation Regarding Importation of Equipment and Its Absorption and Assimilation

In recent years, China has implemented economic policies that invigorate the domestic situation and are open to the outside. All professions and industries have imported a significant quantity of advanced technologies, equipment, or production lines, from which we have had excellent results.

According to statistics, during the period of the "Sixth 5-Year Plan" China imported a total of 14,000 items of technology. Looking just at those items that are already in production in the three areas of Beijing, Tianjin, and Shanghai, for each yuan spent to import there will be generated 2.5-12.8 yuan in output value and 0.5-0.8 yuan in taxes on profits, and the entire amount can be returned within 2-3 years. There have been a definite improvement and rise in both product structures and quality.



However, concurrent with this has been the occurrence of the phenomenon of blind and duplicative importation, and even of mistakes in importation. By the end of 1985 China had imported a total of 150 marble production lines, for which was spent \$150 million; 23 easy-open two-part can production lines have been or are being imported, for an annual production capacity of 4.6 billion cans, which has exceeded the rate for that area of growth during the "Seventh 5-Year Plan"; and by the end of 1985, 54 of the three-part can-soldering production lines had been imported. Equipment of this sort as manufactured by the Qingdao Forging Machinery Plant here in China had passed the technical evaluation by the Ministry of Machine Building, which judged that equipment to be of a 1980's standard. More than a year ago, 15 vegetable oil extraction production lines were imported from Italy, while in China equipment such as that just described has been manufactured in a 30-ton class suitable for township enterprises and 50-100 ton classes for medium-size to large enterprises by units of the Sichuan Packaging and Foodstuff Machinery Company and the Harbin Steam Turbine Plant. Although all of these have attained the standard for the 1980's, they cannot be put into production due to a lack of customers. By the end of 1985, the Liaoning Province Machinery Academy had a draft design sample from absorbing and assimilating an all-purpose pastry filling machine, but with no customers there was no reason to product the pastry. After a certain office in Tianjin Municipality had confirmed this news, the academy still signed a letter of agreement in the first half of 1986 to buy 10 of these abroad.

From the first half of 1976 through October 1986, the city of Shenyang has contracted to buy 590 import items, for a total of \$400 million. But during this period, 78 enterprises absorbed and assimilated only 139 of these, 24 percent of the items imported.

A non-staple food product company in a certain province imported a beancurd production line from abroad. It idled its original equipment, but because the doufu made from the new equipment was priced too high and the taste was not suitable, the enterprise suffered losses, bringing it to the verge of collapse.

In summary, importing technology can bring results, but also errors and problems: one is the great amount of blind and repetitive importation. Another is an emphasis on importation and a slighting of assimilation; more is imported, less is absorbed and assimilated. Even though some things are nationalized, seldom do people look into these things because their hearts are set on importing. Still another is that errors are made in importing, which leads to an overstocking of equipment and funds.

## II. Significance of Absorbing and Assimilating Imported Technology

Since 1950, Japan has repeatedly opened the gates through which technology is imported and has actively encouraged the importation of foreign technology. Table 1 shows that the expense of importing technology in 1970 was 13 times greater than that in 1955. Therefore, the technological recovery of Japan must to some degree be attributed to its importation of technology. The absorption and assimilation of this kind of imported technology depend upon



there being a mature technological base within the country in question. Japan has had its preferences in the technology it has imported, some 80 percent having to do with machines and the chemical industry.

Table 1. Comparison of Japanese Technology Import and Export Expenses

Year	Imports (in billion yen)	Exports (in billion yen)	Exports/imports X100 (percent)
1955	11.9	0.1	0.8
1960	34.2	0.8	2.4
1965	60.1	6.1	7.8
1970	155.9	21.2	13.6
1974	159.8	57.1	35.7
1979	240.9 (26.8)	133.2 (52.1)	55.3 (194.00)

Note: Figure within parentheses is the amount paid for loans in the first year of a newly signed contract.

By a "through dissection" of imported technology, the Japanese have taken the strongpoints of the technologies of various countries, eliminated the shortcomings, and combined an undertaking of "hybridization" and "grafting" based on national conditions with innovation, developing as a result technology that is intrinsic to the country. Since 1977, Japan's technology exports began to surpass its technology imports. The income gained in 1979 from new contracts (for exports) was nearly twice the amount expended that same year to pay for loans for new contracts to import technology. Therefore, Japan is currently a technology-exporting country, one that has implemented a favorable cycle of importation-absorption-innovation-export.

It was pointed out at the Third All-China Conference on Enterprise Technology Progress that the absorption and assimilation of imported technologies and the nationalization of imported equipment and products have become an urgent task for the economic development of China. The Fourth Conference, held a few months ago, proposed that we shift the focus in the importation of technology from its use in production to its absorption and assimilation.

Efforts at absorbing, assimilating, developing, and creating imported technologies include actions in the following four areas (the latter two are what are referred to abroad as "reverse engineering"):

1. Master the basic principles of imported production equipment or production lines, as well as installation, operation, production, and maintenance techniques, in order to manufacture products that attain the standards for quality that are stipulated in contracts.
2. On the basis of mastering design principles, technical tricks, materials composition, the process of techniques, and experimental detection methods, for imported software technologies, generate equipment or products where the quality and performance are in accordance with needs.

3. Absorbtion, draft, design, test-manufacture, and copy key imported equipment to produce new equipment that is similar in quality and performance to the original models.

4. With regard to imported technology or equipment, on the basis of studies to learn well, join with domestic scientific and technical problem-solving efforts to achieve greater innovation and to create new products, new equipment, new techniques, and new materials that reach internationally advanced levels but with our own characteristics.

We have come to realize, through participation in the absorption and assimilation of imported technologies and in drafting and design research over the past year or two, that this is an effective way in which to promote advances in technology, a flourishing economy, construction of a technology system with our own national characteristics, and a quickening of the four modernizations process.

First of all, this can greatly improve the starting points for research. Among new products developed through absorption and assimilation in Shenyang, 80 percent and more filled a domestic void, and all attained international levels of the late 1970's or early 1980's.

Second, this can greatly reduce the time for development. The time used in Japan from absorbing and assimilating one item of imported technology to its transformation into a production force was one-fifth that for those independently developed. We are also largely in the same situation. For example, the ice cream cone machine and thin-noodle production line that we copied through drafting and design generally took 6-10 months from drafting design to production of a sample, but had we independently developed it, it would have taken at least 3-4 years.

Third, this can save a great deal of foreign exchange. The price of nationalized equipment is only about 20-50 percent that of the price of similar imported equipment. For example, the price of the cone machine we developed is 50,000 yuan, while the price of similar equipment bought from Italy was 140,000 yuan. According to incomplete statistics (through the end of November 1985), for the products developed in Shenyang through absorption and assimilation of 34 imported technologies, there was generated a gross output value of more than 100 million yuan, with profits of more than 20 million yuan. This blocked imports and saved more than \$50 million in foreign exchange.

The last point is that with national-standard equipment it is easier to maintain and change fittings. Imported technology brings with it the greatest difficulties in maintaining and changing fittings, and there is thus a long-term dependence on foreign interests. According to statistics, by the end of 1985 China had imported a total of more than 850,000 vehicles of all sorts, with 226 different models. Presently, a significant number of those imported vehicles are due for maintenance, and there are tens of thousands of types and specifications with parts needing repair. Not only can we not get these in time, but they also require a large quantity of foreign exchange.

If we do not do a good job with the absorption and assimilation of imported technologies, there will be a great deal of blind and repetitious importation, even to the extent that we come to depend upon foreign technology and that there is a weakening of the intrinsic technology of this country. Consequently, the gaps will be greater, and this will lead to the vicious circle of even greater quantities being imported. If we can do a good job with this, then it will turn out that importing advanced foreign technology will strengthen our own intrinsic technology, and will gradually increase the proportion of exported technologies. In this way, importation will more and more promote a favorable cycle for China's economy and technology.

### III. Developing Lateral Associations Is an Effective Way To Do Better at the Absorption and Assimilation of Imported Technology

After a period of preliminary tests, we better understand that the absorption and assimilation of imported technology are a systematic process of high, precise, and top-notch technologies that is highly technology intensive and involved with multiple disciplines. With the guidance of national policy and planning, we urgently need to develop strong lateral associations in several aspects, including research, teaching, production, and application. As far as research and design units are concerned, on the one hand they do not have the funds to import advanced technologies and equipment, and on the other they have no capacity for manufacture and production. But they are a professional contingent that is patriotic and devoted to the socialist mission and that has a definite proficiency in research and design and a management capability. Their technological superiorities may be actively integrated with the national defense industry's "shift from military to civilian" in Shenyang, as well as with the philosophy of the small to medium-size enterprises to "cut the rice and put it into the pan," where there is associated development, as well as joint economic returns.

When we began assimilation efforts on imported equipment, the difficulties were rather great. Those departments with samples were unwilling to part with them in fear that they would be helping an adversary, that they would be unable to maintain their own monopolistic position, and that this would affect their economic income; at the same time, they also feared that the equipment would be ruined or that it would not be returned to the responsible department. Those departments agreeing to bring out their imported equipment also want a high price, which they intended to use to increase their capacity for repaying their loans and for supplementing losses incurred from not having the equipment. Enterprises assuming the responsibility for manufacture feared that there would be no market for the nationalized equipment and that after they went into trial production they would not be able to recoup their losses.

After some effort and several experiments, we have cleared the way, and there is finally a pleasing prospect of light at the end of the tunnel. Our particular methods have been:

1. We have catered to society and done investigative research, establishing topics on the basis of market forecasting. We have an information center in

our academy, with specialists to gather data, and we also request that each researcher adopt an outlook that reaches out to society. All are to do investigative research and are to gather data from various channels, after which they are to do market forecasting and economic and technological feasibility analyses. As long as there is importation of technology, market demand, and technical feasibility as well as the desire to provide a sample with which to cooperate, that project will be included among the objects of development.

2. We created the right conditions and effected an association within the department between the sample, the using department, and the factory. In the process of establishing project topics, one knotty problem we encountered was that the factory importing the equipment feared that it would lose its advantage, and that this would affect its own competitive capacity and ability to repay the loans. For example, a Shenyang firm brought in a refreshment stand with all its cold drink equipment and, because of the apprehensions just described, was unwilling jointly to absorb and assimilate that equipment. We patiently talked things over with them and allayed their fears by telling them; (1) If they did not now associate in development, when the equipment is old they will not be able to resolve problems with spare parts; (2) advantages are temporary, and if you do not associate to develop, others will, and if you refuse, the income from the associated development will also be lost; (3) we told them that when importing equipment they were taking a certain risk upon investing the money, and by ceasing production for absorption of the equipment they will also suffer losses, but they can also gain income and compensation by transferring the rights to the technology; and (4) we take full responsibility for any damage to equipment during absorption and assimilation. When we finally convince them, they sign a contract for the development of national-standard equipment through joint absorption and assimilation, mutual benefits, and shared responsibilities. When we take that first step toward association, we will be in joint partnership with the department that has the sample.

Because the equipment was small, the investment limited, and the marketing possibilities great, we chose to deal with it as absorption, to do designs in preparation, and to await transfer of the rights to the technology. Facts have shown that this method is a race against time, so the rights to blueprints for four types of equipment were transferred at appropriate times. Among these, we have manufactured national-standard samples of the ice cream cone machine, the soft ice cream machine, and a freezer, and the other, a hard ice cream machine, has not yet been produced due to problems at the manufacturing plant. The ice cream cone machine, the ice cream machine, and the freezer have all been welcomed in the marketplace. Two firms have taken up the production of each of these, and yet another is currently involved in negotiations for the transfer of rights.

Some other departments have been importing equipment for several years, have returned their investment, do not need to share profits, and need only blueprints and help with parts and easily damaged components in equipment when undertaking major repairs. We have also signed mutually satisfactory agreements with them regarding joint absorption and assimilation.

Yet another problem we have encountered is that although there is a sample of a piece of large-scale equipment or a production line with which to work, when the design is complex and a great deal of manpower is required and the investment needed for manufacturing is excessive, there will be no customers who dare to manufacture it. We associate first of all with the using units, and when we have an association with a customer unit, manufacturing enterprises compete to undertake manufacture, and a new association is formed immediately. As for example with the thin-pasta production line, where after we discovered it nothing was done for half a year, a small amount of manpower proceeded to absorb it and do preparations while customers were actively sought out. After finding the customers, the other party demanded that a complete set of equipment be turned over within 9 months after signing of the contract. Penalties would be assessed according to the number of days past due, and if the quality were not attained the economic losses would have to be compensated. In addition, only 3 days were allowed to stop the machines for absorption. Because of the technical preparations we had done beforehand, and the fact that we had a well-thought-out plan and were willing to take this risk, the other party signed the contract. In only the 3 days the machinery was shut down, our designers finished their drafting and completed their designs ahead of schedule in just over 60 days of struggle. We entered an association for manufacturing with another light-industry enterprise. Cooperation among the three parties went quite smoothly, and the whole thing passed an on-line empty operational test run in November 1986 in Shenyang, and by year's end it had completed its full-load test run.

The third problem we have encountered occurs when the department importing the equipment has already signed an agreement for joint development, but their responsible department puts up obstacles which temporarily bring things to a halt. When information is insufficient there can also be occasions where there is duplicated absorption and design, which leads to a situation of difficulties with the transfer of rights to technologies.

Having engaged in bilateral relations over the past 2 years, and having developed the reverse engineering research on 14 imported production lines or items of equipment, designs have been completed for the thin-pasta production line, the Hualian ice cream production line, the two-color soft ice cream machine, the pneumatic ice cream cone machine, the manual ice cream cone machine, a freezer, a hard ice cream machine, an automatic meat slicer, an automatic drycleaning machine, a deep fried potato chip production line, an automatic wetcleaning machine, a drink can pressurized canning machine, a ceramic mosaic pressed-brick machine, and the all-purpose dessert filling machine. From statistics concerning nine items already in production (see Table 2), for a volume of transactions in software contracts of 700,000 yuan, economic results of 215,000 yuan have already been realized. It is estimated that within 2 years these will generate an output value of 13,635,000 yuan, for a savings of \$10,273,000. Ninety percent of the national-standard equipment has attained levels equivalent to those of the standards of the 1980's. We have gradually implemented two changes in guiding ideology and in the focus of efforts, namely, a change from the simple scientific research model of the past that developed vertical research topics within a particular system to a research and new-product development operations model that transcends

Table 2. Table of Results from the Development of Domestically Produced Equipment Through Absorption and Assimilation for the Years 1985 and 1986

Number	Name of Domestically Produced Equipment Put into Production Through Absorption and Assimilation	Direct Income for Academy (10,000 yuan)*	Social Results			Production Line or Equipment Unit Cost		Level of Domestically Produced Equipment
			Generated Value (10,000 yuan)		Savings (\$10,000)	National-ized (10,000 yuan)	Imported (\$10,000)	
			1986 (actual)	1987 (est)				
1.	Thin-pasta prod. line	7 (5.6)	60	120	180	30	30	early 1980's
2.	Hualian ice cream line	50 (6)	0	300	150	100	50	early 1980's
3.	Two-color soft ice cream machine	2 (0.8)	4.8	320	304.5	1.6	1.5	early 1980's
4.	Pneumatic ice cream cone machine	4.4 (1.6)	10	100	110	5	5	early 1980's
5.	Manual ice cream cone machine	2 (0)	1.7	85	51	1.7	1	early 1980's
6.	Freezer	3.5 (2.25)	6	60	44	0.6	0.4	early 1980's

[Table 2 continued on following page.]

[Table 2 continued]

Number	Name of Domestically Produced Equipment Put into Production Through Absorption and Assimilation	Direct Income for Academy (10,000 yuan)*	Social Results			Production Line or Equipment Unit Cost		Level Domestically Produced Equipment
			Generated Value (10,000 yuan)		Savings (\$10,000)	National-ized (10,000 yuan)	Imported (\$10,000)	
			1986 (actual)	1987 (est)				
7.	Hard ice cream machine	3 (1.3)	2	40	42	2	2	early 1980's
8.	Auto. meat slicer	3 (1.2)	1	50	40.8	0.7	0.4	early 1980's
9.	auto. dry cleaner	5 (2.8)	128	40	105	8	5	late 1970's
Totals		79.9 (21.55)	213.5	1,150	1,027.3			

\*Number outside the parentheses includes amount of transaction for a software contract, within parentheses, is thenumber of items already received.



professions and grows in synchronization both vertically and horizontally. In this new trend, local medium-size applications and development research institutions will not only gain certain economic results for themselves and find new ways to adapt to future reductions in operating expenses and to reach responsibility for their own profits and losses, but will also make rightful contributions to the absorption and assimilation of imported technology, as well as to the development of nationalized equipment, to the renewal and updating of machinery products, and to an increase in the variety of products.

#### IV. What We Have Learned and Suggestions

The absorption, assimilation, development, and innovation efforts regarding imported technology are a systematic process involving high technology, high investment, and high risk. These efforts are wide-ranging and touch upon many problems of a policy nature. It is not enough to rely upon the technology and industrial sectors; instead we require the support and guidance of state and local governments, as well as the support of all areas of strength in society, before this can be accomplished.

1. Improve our understanding of the role of absorbing and assimilating imported technology for the progress of technology. Turn around the thinking that "emphasizes importation and slights absorption." We cannot see the importation of technology simply as a means of increasing enterprise production capacity, but must see it as promoting technological progress throughout society and as expanding the economic and technical potential for reproduction. We want to make our country prosper and to enrich later generations, and we cannot always remain behind foreigners, always letting other people earn our money.

2. Perfect policies and decrees regarding technology importation and nationalization. On the one hand, encourage the importation of advanced technologies that have never been imported, and limit blind duplicative importation (West Germany provides a 30 percent subsidy to departments importing advanced technology and equipment for the first time). On the other hand, to encourage efforts at the absorption, assimilation, and nationalization it is not enough just to reduce the taxes on new products. Regarding investment in the samples for new products, responsible offices and bureaus should also provide an appropriate subsidy to the manufacturing plant; circulating funds for batch production also requires the national bank to extend credit; for state import/export companies or pertinent departments to limit imports also means support for nationalization; and the growth of nationalized equipment can also naturally reduce funds used for importing. These two things are complementary, and if done well they will promote each other. If not done well, this will lead to a vicious circle. We should perfect the examination and approval system for importing equipment, should be strict about the limits of authority for examination and approval, should manage without being stifling, and should be relaxed without leading to anarchy.



3. Strengthen the planning and coordination of efforts at nationalization. Medium- to large-scale projects focus on "government-run" lateral associations, and are also provided with supplemental funding; small to medium-size projects focus on "civilian-run" lateral associations, and in principle they pay for their own development. But both require coordination and guidance to avoid blind, duplicative absorption and assimilation and to overcome monopolistic and suppressive practices. For each U.S. dollar that Japan has spent importing technology, it has spent from \$2 to \$3 for absorption and assimilation. But we spend next to nothing. The funds used by Shenyang for absorbing and assimilating imported technologies are only a small proportion of the expense of bringing it in, which is not conducive to the growth of this work.

4. From the level of the central authorities down to the provinces and the municipalities, select some research work for academies and institutes that is exclusively engaged in the importation of technology and in reverse engineering.

5. We must break down the barriers between departments, systems, and regions, broadly take up the development of lateral associations, and even use the method of open bidding. This will make the most of our strengths and supplement our weaknesses, will make the most of our advantages in all areas, will hasten the process of development, and will improve the quality and level of development. Higher-level responsible departments should support lower-level units in formulating associations that transcend professions and regions.

6. Establish information networks to strengthen statistical efforts. Either periodically or randomly issue information about imported technologies and their absorption and assimilation for use in guiding the healthy development of the absorption, assimilation, and nationalization of imported technologies. We must not suppress these things and must not harm our own people just to preserve the secrets of foreigners. We should establish regular statistical networks for imported technologies, as well as for absorption and assimilation efforts. We should include the vertical statistics from departments and systems and comprehensive bilateral statistics by sectors. These things will help us promptly discover situations and serve as timely guides.

It is our belief that if we are to do a good job with lateral associations, and to promote work on the absorption and assimilation of imported technologies, then the efforts of research academies and institutes are necessary. But we also need broad-based coordination in society, especially regarding the overall guidance and control of the state. In summary, we need the joint efforts and coordination of all aspects above and below and left and right before we will be able to lead absorption and assimilation work in this country along the path of healthy development, and before we can catch up to the levels of developed countries within a short amount of time. Regarding the gap in economies and technologies between the advanced countries and us, if we sail against the current and not shrink back, the implications will be great. We hope "by all means to avoid the threat of vicious circles."

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FLUID STATE HEAT TREATMENT TECHNOLOGY ADVANCES

Beijing ZHONGGUO JIXIE BAO in Chinese 2 Dec 86 p 1

[Report by Xiang Xiaofang [0686 1420 2397]: "The Rectification Method Heat Treatment Technology in this Country Comes Out of a 'Time of Depressed Fluctuation'"]

[Text] News has come from the national annual meeting for fluid state method heat treatment technology held at the Jiangsu Academy of Engineering 14 November: after more than 10 years of reversals, fluid state method heat treatment technology in this country has come out of a period of depression and fluctuation to begin real application in industrial production.

Flux method heat treatment technology is divided into the two types that either involve a flowing ion furnace or a fluidized bed reactor. These began in the United States during the 1960's, and were brought into this country in the early 1970's. Because at that time it was fashionable that the masses should run science research and "to blossom all over the land" was in effect, batch after batch of preliminary ion furnaces were quickly abandoned because of too many defects. At the same time, fluid state method heat treatment technology was progressing in developed countries, and the predicted results showed that it would become one of the new technologies and new techniques the development of which would be an international focus.

Over the last 10 years, specialists and scholars in this country have undergone a series of trials and errors. There have been concentrated efforts at problem solving in eight technical topics regarding fluid state ion furnaces and fluidized beds, which have greatly improved performance, but only one-third or one-fourth of the parts are molded through use of these new techniques in comparison with traditional methods. What is more, the important indices of surface stress state and oxidative decarbonization have had remarkable improvements. At present, five new products in fluid state heat treatment developed by pertinent institutions are exhibiting a very high use value in certain plants, and two among them have been highly praised at international exhibitions. This forecasts that from now on the fluid state method of heat treatment technology will undergo great development within a certain period of time.

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SONG JIAN'S ACCOMPLISHMENTS RECOUNTED

Beijing LIAOWANG [OUTLOOK WEEKLY] in Chinese No 1, 5 Jan 87 pp 24-25

[Article by Gu Mainan [7357 6701 0589]: "Song Jian, An Outstanding Cybernetics Specialist"]

[Text] At the 4th convention of the national Chinese People's Political Consultative Conference (CPPCC) held in April 1986, Professor Qian Xuelin [6929 1331 2651] was elected to be the vice-chairman of the national CPPCC. Scientists at the Ministry of Astronautics gathered especially to congratulate him. On that occasion, Minister in Charge of the State Science and Technology Commission and famous cybernetics specialist, Song Jian, had conveyed to him a congratulatory letter. Song Jian said in this letter, "Today, at this time when the party and the people have given rightful acclaim in this way to an outstanding scientist who has made contributions, we offer our heartiest congratulations to you!"

Amidst the words of praise for him, Professor Qian Xuelin was moved to say, "Thank you, comrades, but I have done only what an elder scientist should have done, and that has been nothing deserving of praise." He hesitated for an instant, then said, "If you want to congratulate anyone, I would recommend congratulating an accomplished scientist. He is younger than I, and that is none other than Comrade Song Jian!"

This name Song Jian is not an unfamiliar one in China, nor among cyberneticists throughout the world. But, perhaps people have not realized that this outstanding scholar in the field of cybernetics has had legendary experiences. He has become a scientist of today through being a "little 8th Route Army man."

Song Jian was born in a small city, Rongcheng, at the edge of the Bohai Sea. In the 1940's he joined the 8th Route Army. No matter how arduous the warfare environment, whenever he had a spare moment he would be studying. He was extremely fond of reading about scientific knowledge and literary works. After the liberation of the entire country, he was sent to Harbin Industrial University for study. He completed his first year with a remarkable record, and qualified through examination for study abroad in the Soviet Union. During his 4 years in the artillery department at the (Bao Man [0545 2581]) Industrial Academy in Moscow, he easily answered all questions during each

examination. Upon graduation, the school awarded him a gold medal, and recommended him to the famous cyberneticist, (Fei Lie De Bao Mu) as a graduate student. During his time as a graduate student, in addition to completing his graduate work in an outstanding manner as assigned to him by his advisors, he also taught classes in "Modern Cybernetics" to Soviet college students and foreign students from various countries, one of the few Chinese instructors at Soviet colleges. During this time, he kept up his studies in the departments of mathematics and dynamics at Moscow University, taking the complete curriculum in those departments, obtaining his second college diploma and laying a firm foundation for later theoretical research.

During the time he was studying in the Soviet Union, both as an undergraduate and a graduate student, he suddenly became a young scholar known throughout the world. Within a few years, he published six papers in Russian, solving for the first time optimum control in a three-dimensional space, designing, proving, and even implementing optimal control for the dual parameters of a DC motor, establishing the theory of dual parameter optimal control, and accomplishing material experiments. Many of his papers were collected by his advisor Professor (Fei Lie De Bao Mu) in the book "Optimal Control Systems Theory." Later, academicians at the Soviet Academy of Sciences and the American Professor E. B. Lee sought to include these results in their monographs. Song Jian established the equal fields theory of optimal control, and became one of the few scholars who were among the first to propose this concept at that time.

In 1956, Qian Xuelin encountered all sorts of obstacles, and having returned to the new China that had been born not long before, quickly put his efforts into the work of creating and making guided missiles. He and Song Jian had never met before, but he aware of Song Jian's accomplishments. When someone praised his accomplishments in cybernetics, he would sincerely say, "No, the current authority in cybernetics is not me, but Song Jian!"

After years of arduous study, Song Jian obtained the position of doctoral candidate in the Soviet Union. But many scientists believed that his papers had reached the level of the doctorate. His advisor, Professor (Fei Lie De Bao Mu), also made preparations for his doctoral dissertation defense. Just at this time, relations between China and the Soviet Union suddenly worsened. Without hesitation, Song Jian complied with the directive of his organization and in 1960 he quickly returned to his country.

Back within this country, Song Jian had no particular chance to rest, but reported to his former post at Branch Academy No 2, Institute No 5, of the Ministry of National Defense, where he joined with other scientists to try their hands at the development of guided missile weaponry. In 4 years, he led the overall design of the first generation of ground-to-air guided missile control systems. At this time, the guided missile mission in this country was still at an initial stage, and he and his companions joined to solve all sorts of technical difficulties through repeated explorations and experiments. They successfully completed the design, experiments, and finalization of guided missile control systems. Just as he was the earliest to apply optimal control theory to the design of guided missile control systems, he used steepest control theory to solve the problem of rapid entry in initial guidance.

"Coordinate Transformation in Guided Missile Control," which he compiled, has had a guiding effect not only on air-to-ground guided missiles, but also on ground-to-ground and air-to-air guided missiles. At the same time as these achievements appeared successively, he enthusiastically personally lectured, and has fostered the first generation of science and technology personnel in this country who are engaged in the design and study of guided missile control systems. And he joined scientists such as Qian Xuelin, Hua Luogeng [5478 5012 1649], and Guan Zhaozhi [7070 5128 4160] in founding the first cybernetics laboratory in this country, which has served a pioneering function in promoting and developing the contemporary scientific study of cybernetics in this country.

As Song Jian has recalled, the 3d congress of the International Federation of Automation Control will be difficult to forget. China had only recommended one paper to be presented to the conference. That was personally selected by the elder scientists such as Qian Xuelin and Guan Zhaozhi, and the topic of which was the "Analysis and Synthesis of Linear Steepest Systems." At the conference, Song Jian, then 31 years old, was the youngest scientist to read a paper before the more than 1,000 scientists there, that paper that he and another science and technology person, Han Jingqing [7281 0079 3237], had written together. Scholars at the conference put up posters just to announce this event. Famous American scientists such as (La Sai Er), (Niu Si Da), and (Zhang Shou Lian) could not stop praising this unique research achievement, and after they had heard the report they went in great numbers to where the Chinese delegation was staying to offer congratulations.

The youthful Song Jian was certainly not intoxicated by his existing successes. Not long after returning to this country, an even more arduous and momentous effort was placed on his shoulders. The book "Project Control Theory" is a famous work by Qian Xuelin, and the English edition published in 1954 has made its way throughout the world, and in 1956 the Soviet Union published a Russian edition; after publication of the Chinese edition in 1958, it was awarded a national first-class science award. Now, Qian Xuelin transferred the arduous task of revising this work that was seen as a classic in cybernetics circles both domestic and foreign to the still not too well-known Song Jian. Song Jian happily accepted this great trust from Qian Xuelin.

It was just at this time that the national defense science research effort in this country was progressing intently. Chairman Mao Zedong proposed that "where there are spears, there must be shields." That is to say, if there are guided missiles, there must be missile defenses. "It couldn't be done in 5 years, nor 10 years, but 15 years" by which time China's missile defenses had to be developed. During the day, Song Jian put all his effort into running around directing research efforts in missile defenses, and in his off-time revising Qian Xuelin's book with great concentration. Accomplishing this voluminous project took not 1 day, nor 1 year, but 10 years of holidays and evenings. He often began at 10 in the evening and worked until 1 or 2 in the morning. In the end, this book was increased from some 400,000 words to 1.2 million, and was published by the Science Publishing House in two volumes.

"Song Jian is a scientist who has research abilities; he is a technician who also has the ability to resolve practical problems, which is something that the ordinary person cannot do," says Qian Xuelin.

One day, Song Jian presented the revised "Project Control Theory" to Qian Xuelin, and after Qian Xuelin had carefully looked over the revised manuscript he said happily, "This book belongs under the names of you young people. You have done so much work, we are going to break through old and outmoded convention and learn from Premier Zhou!"

But Song Jian would not agree. He said sincerely, "Elder Qian, we have only helped you with some particulars, and it can only appear in your name."

"No, it cannot have my name. At most, I will appear as the original author," maintained Qian Xuelin. After trading concessions, in the end Qian Xuelin wrote in the preface that "the authors of this new edition of "Project Control Theory" are the young cybernetics scientists of China who have been forged at this time in history. They, and especially Comrade Song Jian, have taken charge of organizing and even personally writing the manuscript, they have done the majority of the work, and are the creators of this new edition." And so this cybernetics masterpiece appeared in the world.

To commend this outstanding contribution by Qian Xuelin and Song Jian to the development of cybernetics, "Project Control Theory" was awarded a national literature award for outstanding science and technology.

In the mid-1960's, military science research in China turned to a new page. The Central Committee military commission resolved to develop anti-missile missiles, and this is the most complex armament among missile weaponry. Senior design engineer Song Jian accepted the responsibility for establishing an institute. Just as he was working around the clock guiding the development of anti-missile missiles, the decade of turmoil began. He was continuously criticized. Under the care and protection of Premier Zhou, he was sent to a certain missile test site. In these adverse conditions, he never lost heart nor was dispirited, but dived into the base library and taught himself astronomy, quantum mechanics, atomic physics, and high-speed aerodynamics, as well as doing large amounts of exercises and taking copious notes. That the state will become stronger and more prosperous is a grand historical current that cannot be contravened. And it was as expected, for suddenly one day word came from Beijing: they now needed Song Jian to come away and take over work. In a few days, Song Jian once again took the road back to the capital.

Back in his work position, every week he and people like Yu Jingyuan [0060 2529 0337] and Tang Zhiqiang [0781 1807 1730] met to study problems such as control and distribution parameter theories of missiles, sometimes to a degree of great obsession.

At this time, Song Jian was in charge of the science and technology division of Institute No 2 of the Ministry of Astronautics. He had nearly no leadership framework, but always discussed problems and exchanged views in a spirit of comradeship and mutual equality. In abnormally difficult conditions, Song Jian went against the wind to lead several younger people in



completing the jobs of overall design, technical designs, the design of model missiles and independent return missiles, trial production, and test flights for this country's first group of anti-missile missiles. During that time, he learned English on his own. In 1975, in the second issue of CHINESE SCIENCE Song Jian published his famous paper "Distributed Coefficient Control Systems with Constant Disparate Controllers." Publication of the foreign language versions of this paper elicited strong responses internationally. Some foreign universities and research organizations sent numerous letters asking for offprints.

After the "gang of four" had left the stage, Song Jian was in his element and went back to day and night study. He also gathered his energy to take responsibility as the first deputy senior designer for solid-fuel submerged missiles to be fired from nuclear-powered submarines, and also assumed the position as assistant director of Academy No 2 of the Ministry of Astronautics. He did much to lead scientists and technicians in developing new types of missiles as quickly as possible. And 1982, too, will be unforgettable for Song Jian. After years of arduous struggle, the "Julang 1" solid-fuel submerged missile developed by him and others was successfully launched.

As the 1970's began, Song Jian set his hand to resolving the problem of controlling elastic vibration in airborne vehicles, and with the cooperation of people like mathematician Guan Zhaozhi, he established a distribution coefficient system control theory with Chinese characteristics, which for the first time proposed and established a mathematical model for elastic vibration control. They also proposed design theory and design plans for flight vehicle automatic pilot devices, as well as another series of control theory problems. This work received national natural science awards in 1982. Science circles both in China and abroad praised these research achievements highly, recognizing that these achievements "undoubtedly have great importance in the fields of the natural sciences." Specialists in automated control circles in England, France, and the United States, as well as in India, Mexico, and Japan, said that the research efforts of Song Jian and his lecture activities in relevant countries have brought credit to the Chinese.

After this, Song Jian was made vice minister of the Ministry of Astronautics concurrently with his position as senior engineer in charge of the development of military computers and communications satellites. The development of the "331 Information Monitoring Network" that he proposed and led was successful, which was of great importance to the launching and positioning of communications satellites. In the process of launching the first and second satellites for China, he made suggestions and scientific predictions regarding decision making in the areas of resolving various difficulties, extending the life of satellites, and the success of positioning. For this, he was praised by the Party Central Committee and workers in science and technology, as well as by officers and men at the test sites.

Song Jian has not stopped searching and exploring, and he has left his mark on forward progress and will be remembered for that. Since the end of the 1970's, he has generated yet another new scientific idea--how to apply cybernetics in the social and economic systems. After this, he has again been

using his spare time to lead a group in cybernetics, systems engineering, and computer technology, and has taken up the study of how to control population growth in this country. After years of effort, he established a population mathematical model for China that for the first time has proposed a 100-year forecast for the population in this country. Then he made regional population forecasts for more than 20 provinces, municipalities, and autonomous regions. These achievements have provided a scientific basis for the party and governments to formulate population policies. In his academic lectures, the well-known American population specialist (Kao Er) has acknowledged that "Song's studies are completely different from the research methods used in the West," and that his research "has been of a very high theoretical skill."

Since the 1980's, he has studied social and economic problems in this country. In his "Quantitative Methods for Social Science Research," he noted that "to make a quantitative abstraction of problems that need study among social phenomena, and to use quantitative methods to describe their states and processes shows the improvement in the intellectual capabilities of mankind, and is one of the characteristics of the modernization of the social sciences." He also noted "a transition in implementing the social sciences from a descriptive science to a precise science." These scientific concepts of his attracted an ardent response from social science circles in this country. Later, he also directed people like Bi Dachuan [3968 1129 1557] in using quantitative methods to study problems like those of financial subsidies, commodity prices, and wage adjustments as posed by commissions for the restructuring of national systems. It took more than a year to establish a mathematical model for this system, with which he undertook 85 different policy simulations and which provided a scientific basis for restructuring of the national economic system, and which has been an excellent starting point for social scientists and natural scientists to cooperate in solving problems during the restructuring of the national economy.

For more than 20 years, the achievements made by Song Jian have been startling and admirable. This young republic can be very proud that it has fostered scientists of such ability and political integrity as Song Jian.

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## NATIONAL DEVELOPMENTS

### RECENT DEVELOPMENTS IN CHEMICAL REAGENT INDUSTRY

Beijing HUAXUE SHIJI [CHEMICAL REAGENTS] in Chinese Vol 9, No 2, 28 Apr 87 pp 116-117

[Article by Yang Kaiwu [2799 7030 2976]: "Chemical Reagent Industry Has Made Some Progress"]

[Text] Thirty seven years after the PRC was founded, China's chemical reagent industry has become an independent industry of a fairly high standard. The seven chemical reagent production bases established in the early 1960's now employ over 15,000 people, of whom 11 percent are technical personnel and over 55 percent have senior high school qualifications. The key enterprises have begun a shift toward technology-intensive production. With more than 6,000 varieties of products and a gross output value of 530 million yuan in 1985, the industry has become an indispensable component of the country's chemical industry. In addition, scattered in provinces and municipalities around the nation are 350 small and medium-sized chemical reagent enterprises capable of producing chemical reagents in common use. A number of colleges, universities, and research units also play a useful role by making some varieties of chemical reagents that are more difficult to produce.

The seven production bases have also made big strides technologically. In response to the needs of electronic technological developments, several types of ultra-clear, high-purity chemical reagents and photo-etching rubber as well as materials for polishing, epitaxy, diffusion, corrosion, and cleaning have been developed successfully. They have been batch-produced and are now on the market. Of them, 22 varieties of ultra-clear, high-purity reagents of the BV-1 class, the BP-212 photo-etching rubber, TSE-2040 etching fluid, and electronic gas are on a par with similar foreign products. Moreover, a good number of high-purity materials, fiber optics materials, scintillation materials, sensitive chemical materials as well as some special varieties of fine chemical products have been developed. Reagents used in environmental analysis and clinical diagnoses have also been produced to meet the urgent needs of the national economy and people's livelihood.

At the same time as new reagents are being developed, the standards of production technology at key enterprises have also improved correspondingly. Synthetic chemical reagents now account for a substantial portion of all chemical reagents. Several organic synthetic reactions, such as photochemical

reaction, catalysis, and double transfer have been extensively adopted in unit operations. In refining technology, new processes like distillation, complex extraction, fractional crystallization, and chromatographic analysis are also in use nowadays.

As far as quality control is concerned, apart from the chemical reagent monitoring and testing center of the Ministry of Chemical Industry set up in 1978 and 6 large regional testing stations, 25 provincial-level testing stations have been created in recent years and a group of quality control personnel have been trained. Thus a nation-wide chemical reagent testing network is now in place. It plays a significant role in quality monitoring and testing and enables the coverage of quality control to exceed 90 percent, effectively controlling the quality of chemical reagents and eliminating unplanned production. A license system for the production of chemical reagents has been in effect since 1985. Under the system, a production license will be issued to an enterprise only when its production conditions, testing conditions, and the quality of its products are determined to meet certain standards after rigorous examinations. By late 1986, 344 enterprises nationwide had been granted production licenses to produce 2,657 varieties of chemical reagents.

It is clear from the above that China's chemical reagent industry has made some progress in production technology and management. But one cannot be optimistic about the prospects. Industry-wide, the most striking problems remain the narrow range of products, indifferent quality, and low technological standard. The industry has failed to keep pace with national economic development. This is particularly true with regard to product variety, where no basic measures have been taken. For various reasons, such as the enterprises' poor quality, backward equipment, low managerial standards, and the failure to implement technical and economic policies, more than 1,000 varieties formerly in production are no longer made. Between them, the seven bases make just about 7,000 varieties of products a year, not counting duplicates. Even varieties in commercial production number only about 6,000, still far short of market demand.

Influenced by economic results, specialized chemical reagent plants are faced with the adjustment of their product mix. It is no longer possible for enterprises which produce chemical reagents exclusively to increase their economic returns because of the need to produce a diverse range of products in small batches. Consequently, they must modify the product mix as soon as possible. On the one hand, they have to consolidate and improve their existing product lineup to keep their reputation. On the other hand, they must gradually develop as their economic mainstay a number of upscale chemical products that can be produced in bigger batches and are relatively stable, depending on the market conditions. When that happens, the share of chemical reagents in the total output of an enterprise will certainly decline. As the policies of opening to the outside world and economic vitalization continue, non-specialized chemical reagent plants must constantly diversify their product lineup. But technology will steer them away from technically more complex varieties and toward commonly used reagents the supply of which already exceeds demand on the market right now. Inevitably there will be fierce competition between specialized and non-specialized chemical reagent

plants. While there may be a demand for them, small products involving relatively complex technology and are made in small batches should gradually be produced by scientific research units and institutions of higher education equipped to produce chemical reagents. But they must be supervised to avoid haphazard production. This is one issue management departments need to examine closely.

In order that the development of product variety in China's chemical reagent industry is compatible with international development trends as well as domestic conditions, all specialized chemical reagent plants should develop a set of upscale chemical products based on the reagents' uses and the characteristics of their production technology even as they develop chemical reagents. At the same time, they should develop a set of chemical reagents in the process of turning out upscale chemical products, depending on the resources available. They should make the two processes supplementary in the interest of comprehensive utilization. That way they will increase their economic results and expedite variety diversification.

Meanwhile the state should take into account the problems of existing chemical reagent enterprises: low technological standards, backward processes, obsolete physical plant and equipment, serious pollution caused by the three wastes, insufficient occupational safety measures for workers, and uncoordinated packaging materials. In addition, these enterprises have limited fixed assets, retain little profits, and have no money to modernize themselves. They can only maintain simple reproduction, unable to carry out technological transformation. The government should offer them preferential treatments in tax, prices, and technological transformation. It should give enterprises expanded authority to retain profits so that they can transform themselves on their own and develop some staying power. This is the only way to effectively expedite the development of chemical reagent varieties in China.

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CSO: 4008/1088

## NATIONAL DEVELOPMENTS

### USE OF CHEMICAL REAGENTS IN KEY SCIENTIFIC RESEARCH UNITS

Beijing HUAXUE SHIJI [CHEMICAL REAGENTS] in Chinese Vol 9 No 2, 28 Apr 87 p 125

[Text] To understand the supply and demand of chemical reagents in China, a count has been taken of the scientific research units that are the largest users of chemical reagents.

The Chinese Academy of Sciences  
reagents used: 8,206 varieties  
reagents commonly used: 1,707 varieties  
reagents imported: 75 percent

The Chinese Academy of Medical Sciences  
reagents used: 1,481 varieties  
reagents commonly used: 446 varieties  
reagents imported: 63 percent  
(excluding diagnostic and other reagents used in hospitals)

Chinese Academy of Agricultural Sciences  
reagents used: 1,974 varieties  
reagents commonly used: 988 varieties  
reagents imported: 51 percent  
(including 204 industrial enzymes)

Sales statistics from the Shanghai Chemical Reagent Purchase and Supply Station:

varieties sold: 16,291  
varieties most commonly used: 834  
varieties frequently used: 3,499  
varieties occasionally used: 12,792

Supply analysis: guaranteed supply in the case of most frequently used varieties; available but delayed supply in the case of frequently used varieties; and inadequate supply in the case of occasionally used varieties. Yet it is exactly the last category whose unavailability has the most adverse effect on scientific research.

What is used is basically in line with what is sold, about 800 to 1,000 varieties. The nation should work hard to ensure their supply.

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CSO: 4008/1088

## NATIONAL DEVELOPMENTS

### BRIEFS

ELECTRONICS FAIR--Beijing, May 23 (XINHUA)--China's first large electronics technology fair opened in Shanghai today. On display are 1,800 electronic products from 360 research institutes, manufacturers and colleges throughout the country. [Text] [Beijing XINHUA in English 0710 GMT 23 May 87] /8309

SHANDONG EXPORTS--Beijing, 23 May (XINHUA)--Coastal Shandong Province earned one billion U.S. dollars from exports in the first quarter of this year, up 26.7 percent from the same period in 1986. The province now trades with 140 countries, and Hong Kong and Macao. [Text] [Beijing XINHUA in English 0710 GMT 23 May 87] /8309

SINO-AUSTRALIAN OIL VENTURE--The drilling of the first exploratory oil well in a Sino-Australian joint exploration area on Hainan Island, Guangdong Province, is expected to begin in September. Drilling will be undertaken jointly by the Hainan branch of the China Petroleum Development Company and the CSR Petroleum Group of Australia. [Text] [Beijing XINHUA in English 0710 GMT 23 May 87] /8309

RADAR STATION--Beijing, 23 May (XINHUA)--A new weather radar station went into operation in Changle County, Fujian Province, today, as part of Fujian's efforts to improve typhoon forecasts over the Taiwan straits. The Chinese-built radar is capable of making accurate forecasts of typhoons within a radius of 600 km. [Text] [Beijing XINHUA in English 0710 GMT 23 May 87] /8309

UNDERWATER-SIMULATION LABORATORY IN SHANGHAI--Beijing, 25 May (XINHUA)--China's first laboratory, which simulates being 300 meters underwater, has been built in Shanghai, today's GUANGMING DAILY reported. China's Ministry of Communications and the Institute of Underwater Technology affiliated with the Petroleum Industry Ministry are in charge of the experiment, in which four "divers" enter a pressurized room and stay there for seven days. The experiment, conducted in China's first laboratory of this kind just built in Shanghai, uses pressurized rooms and an automatic control system, which were all manufactured in China. Researchers said, the experiment will study physiology and assess underwater equipment, and is important in tapping ocean resources and salvaging. [Text] [Beijing XINHUA in English 1040 GMT 25 May 87] /8309

TIANJIN TO EXPORT COMPUTER TECHNICIANS--Tianjin (CEI)--Tianjin plans to export nearly 100 computer software technicians this year. They will work in joint ventures, Chinese companies established abroad, or on contract. The Tianjin New Technology Development Group sent about 30 software technicians to England, France, Federal Germany and Japan last year. [Text] [Beijing XINHUA in English 0615 GMT 25 May 87] /8309

NEW CHEMICAL FIBERS STRESSED--Hangzhou, 2 June (XINHUA)--China is switching its emphasis in chemical fiber production to new varieties, Bei Yulong, a bureau director from the Textile Industry Ministry, said in this capital of Zhejiang Province today. In 1990, he said, the output of physically and chemically modified synthetic fibers is expected to reach 145,000 tons, accounting for 10 percent of the total. China produced 40,800 tons of these special chemical fibers last year, less than 4 percent of the total. Jiangsu Province, China's top producer, turned out 8,690 tons in 1986. China plans to produce 63,000 tons of the new products or 5.73 percent of the total, this year. In the next few years, it will mainly develop imitations of woolen, silk and hemp fabrics, and down, Bei said. China produced more than 1 million tons of chemical fibers last year, ranking fourth in the world or making up 27 percent of the raw materials for the textile industry. It plans to boost the output to 1.45 million tons in 1990. [Text] [Beijing XINHUA in English 1130 GMT 2 Jun 87 OW] /12913

PRC SOFTWARE JOINT VENTURE--Tokyo, 3 June KYODO--Fujitsu Ltd., a leading electronics firm, has agreed to set up a joint venture in China with the Chinese Ministry of Posts and Telecommunications to develop computer software for use in digital telephone switching systems, Fujitsu officials said Wednesday. The deal is aimed at helping China establish a nationwide telecommunications network in line with the projected modernization of its industrial infrastructure, the officials said. Fujitsu will send top executives to help manage the new joint venture, as well as engineers, they said. They declined to reveal the planned location of the new venture, but industry sources expect it to be set up in Fuzhou City, Fujian Province in June. The deal will give Fujitsu an advantage over other electronics firms in obtaining future Chinese orders for hardware for digital telephone switching systems and private branch exchanges (PBX), the sources said. Meanwhile, Fujitsu is providing engineers of Qinghua University and the East China Teachers' University with details of computer software technology, Fujitsu officials said. Fujitsu has entrusted the universities with developing application computer software for export to Japan for use with softwares for its computers produced in Japan, they added. [Text] [Tokyo KYODO in English 0459 GMT 3 Jun 87 OW] /12913

OPTICAL IMAGE FIBER--Beijing, 5 June (XINHUA)--China has turned out quartz multi-core optical image fiber of one mm in diameter, bringing the country to the forefront in the research and production of such fibers. The fiber was made jointly by the Northern China Jiaotong University and the Tianjin Electronic Materials Research Institute. [Text] [Beijing XINHUA in English 1418 GMT 5 Jun 87 OW] /12913

CHEMICAL TRADE FAIR--Beijing (CEI)--Shenzhen will host an international chemical trade and technological cooperation fair from 30 June to 9 July. The fair will be sponsored by the China National Chemical Import-Export Corporation and its subsidiary the Sino-Chem Development Company, Ltd. Discussions at the fair will cover not only the chemical products import-export business, but also economic and technological cooperative projects. Sino-Chem and its branches will announce 50 available projects, after feasibility studies and approval are completed. This fair is the first time for a Chinese Company to host a specialized trade fair, and over 300 foreign chemical manufacturers are expected to attend. [Text] [Beijing XINHUA in English 0628 GMT 8 Jun 87 OW] /12913

ROBOT, AUTOMATION SHOW--Beijing, 16 June (XINHUA)--Several thousand robots, equipment for robot production, computer systems and instruments developed by more than 100 enterprises from all over the world were put on display here at the Beijing Exhibition Center today. The enterprises are from 12 countries and regions, and they are Austria, Britain, Canada, China, France, the Federal Republic of Germany, Hungary, Japan, Poland, Sweden, the United States, and Hong Kong. China has produced more than 100 robots since the early 1970s when it started developing this type of technology. On display at the exhibition are 18 Chinese-made robots for underwater use, painting and welding purposes. During the week-long exhibition, several seminars will be held, at which experts will exchange ideas on the development of robots, computers and instruments. [Text] [Beijing XINHUA in English 1044 GMT 16 Jun 87 OW] /12913

INTERNATIONAL COMPUTER SYMPOSIUM OPENS--Beijing, 24 June (XINHUA)--The Second International Computer Symposium opened today in Beijing. "Computer technology is becoming more popular in China," a symposium organizer said today, adding so far, 8,000 larger computers and 200,000 microcomputers are now being used in China's transportation, energy, electrical and machinery industries, while China's telecommunications, finance, public security and national defense sectors are also installing more computers. According to Li Xianglin, director of the head office for promoting China's electrical industry, "micro and mid-sized computers made in China are now competitive on the international market, and to date, Chinese computer experts are working on 20,000 applied computer projects." The symposium, which will run until 26 June, is hosting 250 scientists from 18 countries. [Text] [Beijing XINHUA in English 1424 GMT 24 Jun 87 OW] /12913

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## SCIENTISTS, SCIENTIFIC ORGANIZATIONS

### WEIXING ELECTRONICS LAB DEMONSTRATES FLEXIBILITY, INITIATIVE

Beijing LIAOWANG [OUTLOOK] in Chinese No 14, 6 Apr 87 pp 21-22

[Article by Zheng Shilong and Tian Jingying "The Secret of the Growth of a Small Electronics Research Laboratory"]

[Text] The Lanzhou Weixing Electronics Laboratory can be termed amazing and unique. Amazing because this laboratory, founded in 1985 with a staff of four, has carried out real small scale research. Unique because it has many distinctions: it has a collective organization, finances itself, accepts responsibility for its own profits and losses, and carries on collective research, design and production in one organization. The Laboratory rented two rooms in the Wuxian Elementary School as offices and one classroom as a workshop having a total floor space of no more than several dozen square meters. These rooms resemble a science and technology exhibition: there is a computer, a plotter, a copier, telephone etc. Everything is in order. The visitor gets a feeling of great activity as each piece of equipment is introduced and from the charts which cover the walls. We learned that the cumulative output value of this one-year-old laboratory is over 800,000 yuan, and it has measuring instruments and equipment worth 180,000 yuan and 180,000 yuan of liquid funds.

We had a conversation with the director of the laboratory, Wang Tiantai [3769 1131 0669], vice-director Xu Damin [6069 1129 3046] and Comrade Sun Boyuan [1327 0590 3220].

The forerunner to the Weixing Laboratory was the Satellite Television Receiver Research Group of the Lanzhou Radio Factory. In 1983, when TV education was not yet developed in China, this research group discovered through a market survey that there was a great potential for satellite television receiver technology. At that time, with crude equipment and little money, they adopted the research topic of L-band satellite television receivers. After achieving some early successes, they won the strong support of Gansu provincial governor Chen Guangyi [7115 0342 3015]. The research group then began developing a K-band satellite television receiver on behalf of the Provincial S&T Commission. Advanced countries are developing K-band technology produces better results for satellite broadcasting than does L-band technology. By 1984, in just six months, they had completed a prototype. In July, in the hottest part of the summer, a research group of five led by Wang Tiantai, Xu



Damin and Sun Boyuan took their receiver and dish antenna on a truck and set out directly from Lanzhou to an experimental site in Fujian. They began the difficult task of finding a television satellite signal. On the 24 September, they were finally successful in receiving the "Lily" program sent by the Japanese television broadcasting satellite. According to the evaluation of the research group at the experimental site in Fujian, "The W-3 model receiver meets the picture quality, the background noise, clarity, color saturation standards of good Chinese color television reception in urban areas." "Judging the picture by international standards it has a rating of 3.5, bright colors, very realistic picture but with a little bit of noise." According to tests at the National Earth Station Reception Evaluation Conference, this receiver's picture quality approaches that of the Xinlian factory BL satellite broadcast receiver. They achieved this very impressive result, comparable to any other in China, with just a small group and a very small investment (an ordinary group couldn't achieve this without 5 million yuan; they did it with only 55,000 yuan) to nearly match the best result in the entire country.

Just as they were about to begin working on research projects the research group confronted a critical shortage of funding which threatened the survival of their group. Seeing before them the potential in their early results, how could they bear to abandon their work? They proposed, "Let's spend our own money to see this project through!". Just at this time the central leadership decided on reforms in the S&T system. This was surely a case of seeing the light after passing through the valley of darkness. Wang Tiantai and several other determined comrades suggested investing funds themselves, taking responsibilities for profits and losses, and applying for a contract for a collective scientific research unit. Their courage was founded on confidence of the unbounded potential of reform. Advanced science and technology will always triumph over ignorance and backwardness. Moreover, they prepared themselves: they put away the iron rice bowl and took up a clay rice bowl. They were not too proud to repair bicycles, radios, and to earn money so that their scientific research projects could be completely carried out.

Just at this juncture, the leadership of the provincial scientific and technological commission heard of this group and, seeing them as the innovators leading the reform of S&T, gave them support and three years freedom from taxes. In May, 1985 the Lanzhou Weixing Electronics Research Laboratory was founded as the first collectively managed unit in Gansu. This unit was free from the interference of the administration, greatly simplifying the authorization process, giving the laboratory greater autonomy, and promoting scientific research and production. The laboratory unlocked the talents of "sleeping giants" and quickly completed development of a K-band (12 GHz) satellite television receiver. They built a receiver for a K-band satellite earth station for the Fujian Electronic Education Center. This year they have imported Maikang Co. (Canada) C band satellite television receiver technology and using a three meter antenna, successfully received broadcasts of the Central Broadcasting Station sent by international communications satellite #5. According to evaluations by experts, the three meter satellite earth station developed by the laboratory is inexpensive, high quality, and is competitive both economically and technically. This C band station has been given to the Lanzhou City Electronic Education Center, the Tianshui

Electronics Education Center, and the Lanzhou City broadcasting station. Many units in Xinjiang, Qinghai, Xi'an, and Gansu have ordered this station. The number of workers at the laboratory have been increasing with the rapid development of the enterprise. The laboratory is looking for people with a talent for scientific research. Today the number of workers has increased from four to fifteen and everyone can employ their talents to best advantage. Now there is one engineer, two technical cadres, four technicians, and eight other technical advisers and legal advisers on contract.

The Weixing Electronics Laboratory chooses research items itself according to what is needed for economic development to order to rapidly convert the results of research into the forces of production. The laboratory has played the role of a "commando force" in taking on a few short term, very difficult development and production problems urgently needed by large enterprises. In June, 1985, the Shanghai Jinshan Petrochemical Complex sent a man to Lanzhou to ask the Weixing Laboratory to take on as a research item the development of an urgently needed electric sulphur removal equipment. Many different varieties of oil, having large variations in their sulphur content are produced by China. The state decided that the proportion of sulphur in the oil entering the catalytic cracking towers should not exceed 5 percent. Thus, electric sulphur removal equipment is vital for oil refineries and petrochemical plants. If these plants do not have this equipment, the imported platinum catalytic agent used in the production of high grade gasoline will lose its effectiveness and the sulphur and water in the oil will cause equipment corrosion, shortening the life of the plant. Replacing the platinum catalytic agent costs US \$20 million. For every day's delay in setting up electric sulphur removal equipment at the Jinshan Petrochemical Complex, the state loses 5 million yuan! Wang Tiantai, who had helped build this equipment in 1977, was very concerned. After discussing the matter with some technicians, he signed the contract. In just three months, they developed the KDT-4 Silicon Content Controller and automatically controlled electric sulphur removal equipment. In addition, they provided electric sulphur control equipment to important state engineering projects such as the Loyang Refinery, the Panjin Tar Plant renovation project, the Liaoyang Refinery, and the Nanjing Ziyi rare earth project. Now they are working on a third generation microcomputer controlled sulphur removal equipment and on the development of develop new mechatronics products.

Superior methods of diagnosis and analysis. Where does their capacity come from? It comes from horizontal cooperation. Horizontal cooperation makes this small nucleus, the "microscopic" laboratory, capable of a great deal of work. While developing K-band and C-band satellite television receiving stations, the laboratory could produce television receivers but not antennas. They signed an agreement with the Xi'an Aircraft Company for joint production. The excellence of the antennas produced by this company increased the competitiveness of the Laboratory's product. When the Laboratory had problems making the housing for the electric sulphur removing equipment it solved the problem by working with the Lanzhou Oil Pump and Oil Lubricants Plant. As a result the plant utilization ratio of the Lanzhou Oil Pump Plant improved. Horizontal cooperation permitted the "small advantages" of the small, decentralized Weixing Laboratory become "big advantages". In technology, in scientific research, and in productivity, it took advantage of the

expertise of many specialists in order to further its own projects. Wang Tiantai pointed out enthusiastically the Laboratory's direction is the development of the "Three C's" (Computers, Communications, and Control) products. This is the general trend of development in electronic products. The enterprise going with this flow according to the rules of the development of the electronics market. Since new generations of "Three Cs" products change very rapidly and the technical demands are very high, developing horizontal relationships with large and medium sized enterprises is necessary for the growth and survival of this small laboratory. Recently, they have signed an agreement with the First Design Institute of the Railroad Department on developing microcomputers. The Weixing Laboratory has concluded agreements with the Lanzhou Petrochemical Engineering Research Institute for developing electrostatic precipitation equipment and electric sulphur removal equipment and with Yingzhan Co. of Hong Kong to develop electronic equipment.

Moreover, they have the advantage of "small boats are maneuverable". By virtue of their small size, simple organization, quick changeovers in production, rapid product development, the management of the institute senses opportunities and acts upon them in areas where large companies do not produce standard equipment. Thus their small advantages become large advantages. For instance, when they want to sell antennas as part of their complete system, they can allow the customer to choose the antenna they want. The Laboratory sells the system with the antenna made by the company the customer designates. In the case of many products of the same kind, and the prices of other people are high, they move the economic lever and lower their own prices. By implementing, in addition to these measures, "Five Contracts" services, the Laboratory has established stable business relationships with large and medium sized enterprises. Last year, the Laboratory accepted an invitation from the Loyang Design Institute of the China Petrochemical Corporation to develop electric sulphur removal equipment for the Loyang experimental refinery. Through testing in the plant, the customer was pleased to discover that the principal specifications of the KD-6 split phase control electric sulphur removal equipment are close to the specifications of the Hebaike Corporation for the same product. Experts believe that this is the first equipment of this type developed in China.

The growth of this laboratory from a closed-down state-run research group to a collective laboratory which assumes responsibility for its own profits and losses is a true microcosm of the reform of China's S&T system. This laboratory, with only a few dozen researchers, has an annual production value of 550,000 yen and profits of 250,000 yuan! This laboratory costs the state nothing, but each member of the laboratory pays their original unit -- the Lanzhou Radio Factory -- an administrative fee of 1000 yuan. The workers and staff at this laboratory can not only enjoy the same compensation as government employees, the laboratory ups the pay of each worker by two pay grades and gives bonuses when appropriate. This laboratory has not only provided a "micro" model for the development efforts of China's electronics industry but have also shown the way for finding, utilizing and rewarding talent.

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